

THE MONIST

THE EDUCATION OF CHILDREN IN ANCIENT ISRAEL.¹

FROM the point of view of race psychology there is scarcely a more interesting and more profitable study than the examination of the way in which the various nations educate their children. Since education aims at the development of children into useful and independent members of human society and at giving them whatever they may sometime need in order to fill their place in life and to meet its demands, we can derive from the nature of their system of education perfectly reliable inferences regarding the views of life cherished by the educators and the ideal of man that hovered before them. And so from the beginning special interest is assured for the question, what a people of such importance for mankind as ancient Israel thought about the education of children and how they applied it.

True, what the Old Testament has to say directly about education is very scanty, but the subject itself is enough to spur us to further investigation. For in order to understand rightly and to estimate properly those scant direct utterances about children and education, one must needs have a clear conception of the views of ancient Israel regarding the family and family life, and accordingly we must include also the main points of this latter important subject within the scope of our immediate consideration. In this study I shall restrict myself to the canonical books of the Old Testament,

¹ Translated from Prof. Cornill's MS. by W. H. Carruth.

claiming outside that sphere only the right to be permitted to examine and use Jesus Sirach. For although the Jews never included Jesus Sirach among the canonical books—for reasons which it would lead too far to explain: not indeed from lack of appreciation or because it was considered unworthy of such an honor—yet it belongs in the period of the Old Testament literature: it was composed fully a generation earlier than the book of Daniel, which has been accepted into the canon, and is for us the most classic witness concerning the opinions of Judaism in the year 200 B. C. I shall also take the liberty of referring on occasion to the book of Tobias, which was written about the same time with the book of Esther.

Matrimony and family life are regarded in ancient Israel as unqualifiedly the normal, divinely established and prescribed state. On the other hand, to estimate voluntary abstinence from matrimony as an especial merit, and to ascribe to it a higher degree of divine perfection and even of holiness, was far from the thought of any one in ancient Israel. The saying: "The Israelite who does not take a wife is not to be regarded as a man," is indeed found only in the Talmud, but certainly expresses the views of ancient Israel. "He who has found a wife has found a treasure and won favor from God," and "House and havings are inherited from one's parents, but a loving wife comes from God," are two among the proverbs of Solomon, xviii. 22, xix. 14. Since matrimony is instituted in Paradise by God himself, it assumes a decidedly religious value. "God himself was the witness of the vows between thee and the wife of thy youth," says the prophet Malachi with touching beauty, ii. 14; and the faithless wife is branded, according to Proverbs ii. 17, as one who has "forgotten her vow to the Lord." In the Proverbs of Rabbi Eliezer this thought is expressed very ingeniously and drastically in that fashion so popular with Orientals, a play upon words and letters. Man is in Hebrew *ish* (*ish*), while woman is *ishshâh* (*ishshâh*). Now these two words have two consonants in common *sh* and *sh*, to which there is added in the word for man a *h*, and in the word for woman a *h*; but these two letters taken together *sh* constitute the shortest form of the most holy name of God which it was forbidden to utter, while the two

common consonants written and read together give the word *esh* (אֵשׁ), meaning fire. Now the proverbs of Rabbi Eliezer have it: God himself has placed his name in the midst of the names of man and wife. If they hold fast to him he will himself dwell in the midst of them; but if they lose his most holy name there is left only fire, that is: a marriage where God is a party to the union is heaven on earth; but a marriage where God is not, which is not entered upon in his name and has not the religious basis, is a hell on earth. One can scarcely imagine a more poetical and winning characterisation of such a marriage formed with the blessing of God than that given in the 128th Psalm: "Blessed is every man that feareth the Lord, that walketh in his ways. Thou shalt eat from the labor of thine hands. Happy shalt thou be and it shall be well with thee! Thy wife shall be a fruitful vine in the innermost parts of thine house; thy children like young olive plants round about thy table. Behold, thus shall the man be blest that feareth the Lord!" (Ps. cxxviii. 1-4.)

Let us now consider how such a marriage was brought about in ancient Israel. First of all we have to prove that opportunity was given the young people to get acquainted and to found a union upon personal attraction and mutual love. For even girls moved with freedom in public life. Indeed they were entrusted with all sorts of tasks which necessarily brought them into contact with young men: they had to fetch water, pasture the herds, and guard the vineyards; furthermore it is known that they went out to meet the returning victors in war and welcomed them with dance and song.

As to the circle from which the Israelite selected his life's companion nothing is definitely prescribed. In the older times at least the choice is regarded as unrestricted. Esau brings home to his parents highly unwelcome daughters-in-law from a foreign race, and when Samson proposes to marry a Philistine woman his parents are not exactly pleased with the plan, but they do not regard it as anything wrong and they themselves conduct the suit for the hand of their son's chosen bride when they find that he insists on his desire. But this was not, indeed, the rule: on the contrary, a man

sought his wife by preference in his immediate circle, that is, in his own family. Thus Laban says plainly to his nephew Jacob, when the latter asks for Rachel to wife: "It is better that I give her to thee than to a stranger," Gen. xxix. 19. And when Samson wishes to marry the Philistine woman, his father says to him: "Is there forsooth among the daughters of our kinfolk and in our own family no woman, that thou wilt take the Philistine woman to wife?" (Judges xiv. 3). Cousins of opposite sex seem especially to have been regarded as predestined to betrothal, since the language calls them expressly *lover* and *sweetheart*, *רַעַב* and *רַעַת*.

This is based upon the old notions which regarded the family distinctly as an ecclesiastical and legal unit, especially in matters of the law of property. From this point of view, therefore, the contraction of the marriage bond was not the establishment of a new family, but the expansion and perpetuation of the family of the father, for which reason it was the rule that the married son remained in the household of his father. If a young man had determined to enter into matrimony and made his choice either at the dictate of his affections or in accordance with the wish of his father, or on some one's recommendation, then his father or some confidential friend sued for the maiden at the hand of her father or her brother: it was not customary for the wooer to conduct his suit in person.

And here we must admit that of the various forms of marriage contract enumerated and classified by ethnographists there existed in ancient Israel only the form of the so-called marriage-sale. If the father of the maiden had given his general consent, it then became necessary to agree on the purchase price which was known by the distinctive name of *mohar*; we have no direct account of the maximum value of this *mohar*, but from a comparison of Deuteronomy xxii. 29 and Exodus xxii. 15 we can infer that in the time of Deuteronomy, that is, toward the close of the kingdom of Judah, the average amount of the *mohar* was 50 shekels of silver. Since we have shekels still preserved, we can at least fix precisely the value of the metal in the same. The shekel of ancient Israel weighed 14.5 gr.: according to the present standard value of silver

14.5 gr. of pure silver would be worth \$0.635, and accordingly the normal price for a wife would have been \$31.75. And from the moment when the *mohar* was paid down and accepted, the marriage was regarded as legally concluded even when it was not yet in fact accomplished. But it is clearly to be inferred from the very vivid account of Eliezer's suit for the hand of Rebecca, Genesis xxiv., that the maiden was not bartered like an article of commerce, but that her consent was necessary, and likewise that the father on the other hand could refuse to give his consent to a union. The first mention of the composition of a written marriage contract is found in Tobias vii. 13, and here the circumstance is involved of sending the daughter far away from home into a foreign country.

And legally considered, the wife was the property of her husband; the husband indeed bears the very name of "owner," *ba'al*, and the married woman is called *ish-shâh be'âlath ba'al*, a woman who has become the property of an owner. But the ultimate reason for this phenomenon we have not to seek in the fact that the woman was regarded as merely a thing, but in olden times the whole house-work and all the domestic industries rested upon the shoulders of the feminine members of the family: a daughter, therefore, was a valuable laboring-factor in the father's house, of which he was deprived, and accordingly it was proper that he should be recompensed and that the family of the bridegroom should pay something in return for the new additional laborer. Accordingly the *mohar* is not much higher than the average price of a slave, which was, according to Exodus xxi. 32, about \$19. And thus also we explain the fact that the bridegroom can offer his own personal services instead of the *mohar*: if he is unable to raise the amount of the *mohar*, he becomes the slave of his father-in-law and thus works it out. Thus, as is well known, Jacob, who, as an orphan and a fugitive, was of course unable to offer a *mohar*, served his father-in-law seven years for his daughter. And I must not neglect to note expressly, if we propose to regard the marriage-contract as really a commercial affair, that it was solely the labor of the bride which was the object of purchase: marriage was never a speculation in ancient Israel, and there was no such thing as mar-

riage for money, for the bridegroom had not only the *mohar* to pay, but had also to meet the entire expense of the wedding festivities from his own means. The bride received no money, neither a dowry for her matrimonial estate nor any outlook for the inheritance after the death of the parents. For according to the notions of ancient Israel the woman is never a claimant of rights but only the object of legal claims, and has accordingly no right of inheritance. What is regarded as a matter of course among us, that the widow shall be the heir of her husband and that the estate of the parents shall be divided equally between the sons and the daughters, the Israelite of old would not have understood at all, but would simply have regarded as demented any one who said and claimed such things. Neither the widows nor the daughters received anything, but on the death of the father the estate was divided among his sons, the first-born receiving double the share of the others, but to offset this he had to assume the obligation of caring for and supporting his mother and his sisters.

Hence the Israelitish maiden never had ground for suspecting, when she entered upon matrimony, that she was being married on account of her money, as a perhaps unwelcome appendage to her property, and thus one of the chief causes of unhappy marriages was removed.

But the question will be asked : What if there were no sons, but only daughters, or perhaps no children at all, and only a widow? In such cases, indeed, the widow and the daughters received the estate, but in this case they had not the free disposal of their own hand; the widow had to marry the brother or the nearest elder kinsman of her deceased husband, and the daughter some member of the father's family, so that the property always remained with his line.

Now, if the negotiations had reached a successful termination, so that nothing more stood in the way of the union of the couple, the marriage feast was celebrated. And here again a very surprising but unquestionable fact is to be recorded. Despite the thoroughly religious character of ancient Israel, despite all the recognition of the religious character and the religious foundation of

matrimony, the Old Testament does not contain a hint of any religious consecration of the matrimonial tie, or in modern phraseology, of any ecclesiastical ceremony. And so, at the time of the establishment of the civil statutes when the clerical party especially protested so vigorously against the recognition of civil marriage, while the Catholic Church even to this day refuses to recognise the civil wedding alone as a valid marriage, they have the direct testimony of at least the older portion of the Bible against them. Ancient Israel recognised only the civil marriage, and indeed, strictly speaking, not even this; for the state, so far as we may speak at all of a state within the borders of ancient Israel, paid absolutely no attention to the matrimonial relations of its subjects: the marriage contract was purely a family affair, involving only private rights. Corresponding to the decisive factor from the point of view of private rights that the bride was transferred from the family of her father to that of the bridegroom, the essential part of the marriage ceremony was the fetching and the solemn home-bringing of the bride from the house of her father to that of her future husband. This home-bringing was accompanied by songs and ceremonies of all sorts, but by nothing in the nature of religious rites. The wedding festivities lasted seven days and were at the expense of the bridegroom: in the book of Tobias the wedding celebration at the house of the father-in-law in Ecbatana lasts fourteen days (viii. 18), and after the arrival of the young couple in Nineveh a further celebration of seven days takes place in the house of the father (xi. 17).

To have children was regarded among the ancient Israelites as the greatest good fortune that God can grant to men; this view is probably expressed most concisely in the beautiful saying, "Behold, sons are a gift of God, and children are the reward of grace" (Psalms, cxxvii. 3). On the other hand, childlessness was regarded as a punishment from God and a reproach in the eyes of men. There is no indication in the Old Testament that any sort of symbolical ceremony was necessary on the part of the father whereby he recognised and accepted the new-born child as his own, as we

know to have been the fact among the Romans and the early Germans,—not even in Job iii. 12.

If the wife herself is regarded in law as the property of her husband, the same is still more the case with the children: in law the relation of wife and children to the husband and father is the same as that of slaves, and accordingly the apostle Paul is thinking and speaking in strictly Israelitic spirit when he says in the familiar passage of Galatians (iv. 1): "So long as the heir is a child, he differeth nothing from a bondservant, although he shall one day be the master of all." So the father had the right to sell the children, under the single limitation that it be not to tribal aliens. And so also he had the right to dispose at will of the right of primogeniture, that is, to divert the right of the first-born to one who was not actually the first-born; at least this prerogative is expressly abolished by Deuteronomy xxi. 15-17. Indeed the father had the right of life and death in connection with the child, that is, he could punish the child, and under certain circumstances (Genesis xxxviii. 24) the daughter-in-law, with death, of course in cases prescribed by custom. The way in which the book of Deuteronomy disposes of these paternal rights is very characteristic. We read there (xxi. 18-21): "If a man have a stubborn and rebellious son, who will not obey the voice of his father or the voice of his mother, and will not hearken unto them though they chasten him; then shall his father and his mother lay hold on him, and bring him out unto the gate of his place to the elders of his city, and shall say to them: This our son is stubborn and rebellious, he will not obey our voice, he is a riotous liver and a drunkard. And all the men of the city shall stone him to death; so shalt thou put away evil from the midst of thee; and all hear it and fear." We do not find that the parents first accuse the son, and that afterwards the elders investigate the case and then punish him. No, the parents are both accusers *and* judges: only the execution is withheld from them. At their request and upon their simple notification the inhabitants of the city must execute the penalty of death against the rebellious son. This is a consistent development of paternal authority similar to that which we see executed by Roman law.

The first care of the new-born child seems not, or at least not always, to have been performed by the parents. But as the Greeks had a "paidagogos," that is exactly, a children's guide, a slave who was charged with the special attendance and care of the child, so in ancient Israel we hear of something similar. Here too we are told repeatedly of attendants and nurses, male or female as the case may be, who looked after the care of the child. They carried the child especially in their bosom, that is, in the folds of the garment over the breast and above the girdle, and later probably taught the child to walk. In the case of royal children they probably remained about the young princes as tutors (2 Kings x. 1 ff.). Thus in a familiar passage Moses says to God: "Am I then the mother of this whole people, that thou sayest to me, Bear it in thy bosom, as a nursing father bears his nursing, into the land which thou hast promised unto their fathers!" (Numbers xi. 12.) And in the book of Isaiah, the future glory of the people of Israel is depicted in the words: "And kings shall be thy nursing-fathers" (xlix. 23). And so, when the son of Jonathan was made lame by the carelessness of his nurse, who, at the news of the defeat in battle at Mount Gilboa, let the five-year-old boy fall in her hasty flight (2 Sam. xlix. 23), as well as in the book of Ruth, which is so full of charming and poetic touches, where we read that Ruth's mother-in-law, Naomi, nursed the son of her daughter and Boaz (iv. 16). And on the subject of learning to walk also we have a picturesque verse. In one of the most touching passages of the book of the prophet Hosea we read: "When Israel was a child, then I loved him and called my son out of Egypt;—Yet I taught Ephraim to go; I took them on my arms" (xi. 1-3).

But in order to enjoy children as a gift of God, they must turn out well and be well trained. "A wise son maketh a glad father, but a foolish son is the heaviness of his mother;" "The father of the righteous may greatly rejoice, and he that hath a wise child may have joy of him;" "He that hath a fool for a son, the same hath sorrow, and the father of a fool hath no joy;" "A foolish son is a grief to his father, and bitterness to her that bare him,"—thus speak the Proverbs of Solomon, x. 1, xxiii. 24, xvii. 21 and 25.

And: "A reproach to a father is an ill-bred son, and such a daughter is to him a great evil"; "Cherish no longing for a multitude of useless children, and take no pleasure in godless sons;—for one is better than a thousand, and better it is to die childless than to have impious sons," says Jesus Sirach, xxii. 3, xvi. 1-3. From such utterances we may fairly conclude that the training of children was regarded as something very important in Israel and that great value was laid upon it. It was expected to begin at a very early age, for "What's bred in youth is done in age" was surely a principle known in ancient Israel as well as elsewhere. "Train the child at the very beginning of his ways, and when he is old he will not depart therefrom," we read in Proverbs, xxii. 6, and "If thou hast children then train them from their infancy," says Jesus Sirach, vii. 23.

Now the first thing that was demanded of the child was absolute respect for its parents. "Honor thy father and thy mother," appears already in the Ten Commandments, and in Leviticus, xix. 3, and xx. 9: "Ye shall fear every man his mother and his father, —for I am the Lord your God;" and "Every one that curseth his father or his mother shall be put to death." The Prophet Malachi says: "A son honoreth his father, and a slave his master" (i. 6). "Be obedient to thy father and despise not thy mother when they have become old;" "A generation that curseth its father and blesseth not its mother,—an eye that mocketh at its father and that despiseth to obey its mother, the ravens by the brook shall pick it out and the young eagles shall eat it," are utterances of Proverbs, xxiii. 22; and xxx. 11 and 17. And on this very point there are some beautiful passages in Jesus Sirach: "Honor thy father with thy whole heart, and never forget what thy mother had to suffer for thee. Forget not that thou owest to them thy life, and how canst thou repay them for what they have done for thee?" (vii. 27-28). "Hear, O children, the commandments of your father, and walk therein, that ye may prosper. For the Lord has made honor of the father a duty of the children, and the commandments of the mother hath he made a law for her sons. He who honoreth his father maketh atonement for sins, and he who honoreth his mother

gathereth a good treasure. He who honoreth his father will have joy of his own children, and when he prays his prayers will be heard. He who esteemeth his father will enjoy long life, and he who obeyeth the Lord will be a comfort to his mother. He who feareth the Lord will honor his father and will serve his parents as though they were rulers. Honor thy father both in word and in deed, that a blessing may come upon thee from them. For the father's blessing buildeth houses for the children, but the curse of the mother destroyeth them. Seek not thy glory in the dishonor of thy father, for his dishonor can never be a glory to thee. For the glory of a man is the honor of his father, and a mother dishonored is a reproach to her children. My son, care for thy father in his age, and grieve him not so long as he liveth. And though he become childish, have consideration for him and despise him not when thou art in thy full strength. For compassion upon thy father will not be forgotten, and instead of the punishment of sins thou buildest thine house. In the day of need thou shalt not be forgotten, and like ice before the sun thy sins shall melt away. He who leaveth his father in need is no better than a blasphemer, and he who grieveth his mother is accursed of God" (iii. 1-16).

One particular sort of respect is especially commended. It seems to have been customary among the ancient Israelites also that the parents withdrew to the old folks' apartments and lived on an allowance. Jesus Sirach gives a most energetic warning against this: "Give not to thy son, thy wife, thy brother or thy friend power over thee so long as thou livest. As long as a breath of life is in thee leave not thy place to another and surrender not thy money to another, lest thou be compelled to beg for it of another. For it is better that the children beg of thee than that thou be compelled to look into the hand of thy son. (xxx. 28-30.)¹ In the same category belong two sayings in Proverbs: "He that spoileth his father and chaseth away his mother, is a son that causeth shame and bringeth reproach" (xix. 26), and "Whoso robbeth his father or his mother, and saith, It is no transgression, the same is among

¹ This is xxxiii. 20-22 in the current German Bible.

the worst criminals" (xxviii. 24). As a matter of course, along with respect for parents the child was trained to all other moral obligations and virtues.

And what sort of pedagogical principles did they have in ancient Israel? That can be told in a single word: the rod. Discipline was indeed very severe,—to our modern humanitarian views absolutely tyrannical. The foremost demand of our theory, that the individuality of the child must be allowed to develop, would have been as incomprehensible to the ancient Israelite as would have been the claim of woman to be an agent of the law. Obedience was the end and all. And since this is not apt to come of itself, it was necessary to resort to drastic measures. When we hear the proverb, "My son, despise not the chastening of the Lord; neither be weary of his reproof; for whom the Lord loveth he reproveth, he chasteneth the son in whom he hath delight" (iii. 11-12), we need not wonder if the earthly father also lays ungentle hands upon his child for its own good. For "he that hath been delicately brought up from childhood will become a servant and end in misery," say Proverbs xxix. 21. (Such is probably the sense of the corrupt and difficult passage.) On this particular point the Book of Proverbs and Jesus Sirach express themselves with all desirable distinctness. "He that spareth the rod hateth his son; but he that loveth him chasteneth him betimes." "Foolishness is bound up in the heart of a child; but the rod of correction shall drive it far from him." "The rod and reproof give wisdom; but a child left to himself causeth shame to his mother." "Correct thy son and he shall give thee rest; yea, he shall give delight unto thy soul" (Proverbs xiii. 24; xxii. 15; xxix. 15, 17). "As is music in the midst of mourning so is a reproof out of place; but chastisements are always proper in discipline" (Jesus Sirach xxii. 6). But here again the most characteristic expression is an extended disquisition in Jesus Sirach: "He who loveth his son letteth him taste the rod continually that he may have pleasure in his conduct thereafter. He who chasteneth his son will have pleasure in him, neither will he be ashamed of him before his friends. He who instructeth his son, giveth offence to his enemy, and will rejoice over

him in the presence of his friends. And if his father die, it is as though he had not died, for he leaveth his like behind him in his place. So long as he liveth he has his pleasure in him, and when he cometh to die he is untroubled. He leaveth behind him an avenger against his enemies, and to his friends one who will remember their kindnesses. But he will spoil his son who takes every blow to heart and who is distressed whenever he weepeth. As an untamed horse is rebellious, so a spoiled son is uncurbed. Treat thy son with delicacy and thou wilt afterwards fear him; play with him and he will afterwards grieve thee. Jest with him and he will cause thee trouble and thou shalt be called to account for his evil deeds. Give him not much freedom in his youth and excuse not his follies. Bend his neck the while he is young and bruise his back while he is small, that he may not become stubborn and disobedient to thee and thou have sorrow because of him. Bring up thy son to labor, lest he give offence and become a disgrace to thee" (xxx. 1-13).

But the strongest, and absolutely shocking for our present feeling, are two sayings from the Book of Proverbs, which for this reason I have saved to the last: "Chasten thy son, seeing there is hope; thou wilt not beat him quite to death" (xix. 18), and "Withhold not correction from the child; for though thou beat him with the rod yet will he not die of it. Thou shalt beat him with the rod and thus deliver his soul from hell" (xxiii. 13-14). For easily conceivable reasons the attempt has been made to eliminate this unmerciful beating from the text by ingenious interpretation of the death as a spiritual death: Chastise thy son, seeing there is hope, lest thou be guilty of his death, inasmuch as he would become the prey of death if he grow up without virtue; or again: Withhold not correction from the child; if thou strike it with the rod it will not die but through severe discipline will become a pious man who will escape the judgment for sin. But this seems to me to be wholly contrary to the sense and spirit of the Book of Proverbs. In fact, that which Luther so aptly translated from Jesus Sirach as "beat his back blue" is literally: "break his ribs." The Oriental is fond of drastic and hyperbolical expressions, which of course

must not be glossed over. That the Old Testament does not regard the father exclusively as the tyrannical administrator of chastisement is sufficiently proven by the familiar passage of Psalms: "Like as a father pitith his children, so the Lord pitith them that fear Him" (ciii. 13), and that the rod was only the last resort, and that they could get along very well without it, is sufficiently shown by the Proverb: "A rebuke entereth deeper into one that hath understanding than a hundred stripes into a fool" (xvii. 10). But all the preceding evidence shows us clearly this: That the family according to ancient Israelitic notions was an absolute monarchy, with the father as absolute monarch at the head. Authority and obedience are its foundation-stones.

But while what we have thus far been considering constitutes what may be called moral education, we must now proceed to inquire regarding intellectual education. What did the child have to learn in ancient Israel? Jesus Sirach speaks, xxx. 3, of instruction given to the son: what may have been the topics of this instruction? Here too the Old Testament leaves no room for doubt on the point that the first and most important thing that the father had to teach his son was religion, that religious instruction was the basis and the starting-point of education. "Abraham will command his children and his household after him that they may keep the way of the Lord to do justice and judgment, that the blessing may come upon them" (Gen. xviii. 19). "They shall learn to fear me all the days that they live upon the earth, and that they may also teach it to their children" (Deut. iv. 10). "And these words which I command thee this day, thou shalt take to heart, and thou shalt teach them diligently to thy children" (Deut. vi. 6-7). The father is directed to use every opportunity in order to give his son religious instruction. On the occasion of the feasts especially the opportunity presented itself as a matter of course. "And when at the feast of the Passover thy son shall ask thee, What mean ye by this service? that ye shall say, It is the sacrifice of the Lord's Passover, who passed over the houses of the children of Israel in Egypt, when he smote the Egyptians, and delivered our houses.—And thou shalt tell thy son in that day: Thus did the Lord deal with

me when I came up out of Egypt" (Exod. xii. 26-27, xiii. 8). The same directions are given in connection with the pillars of stone that were set up at Gilgal in memory of the miraculous passage of the Jordan. "When your children shall ask their fathers in time to come, What mean these stones? then ye shall let your children know, saying, Israel came over this Jordan on dry land" (Josh. iv. 21-22).

A classic testimonial of this religious chain of instruction as the center of all domestic training and instruction in Israel is the beginning of the 78th Psalm: "I will proclaim to you the mysteries of old, which we have heard and learned, and what our fathers have told us. Their children did not hide it, but told to the generations to come the great deeds of Jahweh and the wonders that he did for Israel; how he commanded our fathers to instruct their children in the same, that the generation to come might know it, even the children which were yet to be born and these in turn be zealous to tell it to their children, that they might set their trust in God and not forget the mighty deeds of the Lord" (lxxviii. 2-7). It is the first and most essential element of the instruction to train the children to be pious, orthodox and well-grounded Israelites, and to this end is employed first of all instruction in *Bible history*. According to a familiar passage in the "Sayings of the Patriarchs" the instruction in Bible history was to begin in the child's fifth year.

But what was the status of the proper topics of education? Writing, reading, and arithmetic are things which do not impart themselves, and yet they are indispensable in daily life. Now we have definite evidence that reading and writing were widely known in Israel even in the earliest times. Gideon wishes to punish the elders of the city of Succoth for their unpatriotic conduct. "And he caught a young man," so the book of Judges tells us, "of the men of Succoth, and he was compelled to write down for him the chiefs and the elders of the city, seventy and seven men" (viii. 14). This narrative gives us, to be sure, no evidence regarding the time of Gideon, but it does for the time when it was written: it is a part of the oldest historical tradition of Israel, and in this it is taken as a matter of course that the first comer picked up from the field can

write. Or, to take another case, David's captain Joab was by no means what we would call an educated man, but yet he knew how to read and write, as is shown clearly enough in the incident of the all too famous Uriah letter (2 Sam. xi. 14). The same is true in the time of Isaiah, as indicated in the passage, speaking of the condition of Assyria after the divine judgment, "And the remnant of the glory of Assyria shall be small, that a little child might record it" (x. 19), that is, make a list, an inventory of it. And the fact that judicial procedure at the time of this great prophet was documentary, as is the case in the Orient at the present day, is proved by the circumstance that Isaiah characterises unjust judges as "writers that write perverseness" (x. 1). At a peculiarly important crisis of his prophetic activity he is required to take a tablet before witnesses, on which he is to write "with human pencil," that is, in the common cursive hand, the mysterious words "The spoil speedeth, the prey hasteth." And along with this, the oldest monument of Hebrew writing known to us, the Mesa stone of Dibon, erected by a contemporary of the prophet Elijah, exhibits so distinctly and perfectly the characteristics of cursive script as to demonstrate the existence in Israel of a long-practiced art of writing.

But the Old Testament nowhere gives the slightest hint of public schools or of professional teachers. The attempt has been made to find in a very obscure passage of Isaiah, xxviii. 9-13, an allusion to instruction in reading of written characters imparted by a teacher: the defiant and conceited princes of Jerusalem are not willing to be treated like schoolboys by Isaiah, as we would express the idea, but Isaiah has nothing to say of a public school and of methodical instruction in the reading of manuscript imparted there. Hence we must assume, since the art of writing was widely cultivated, that writing, reading, and reckoning were taught in ancient Israel at home and by the father alone, that no school interposed its disturbing and hostile influence between the child and its parental house: nevertheless they thrived excellently without it, and it is easy to imagine how such a close association of children and parents, to whom the parental house was everything, must needs bring to family life a warmth and to the feeling of solidarity a per-

manence, of which we people of modern times have as yet no notion, for the dominant tendency of our time is to reduce the sphere of home and family bit by bit and to make of man nothing but a mere figure in the census reports and the tax rolls.

And now I must give answers to two questions which have perhaps been busying the attention of my readers, and especially the ladies, for some time: What of the mother and what of the daughters? Hitherto only son and father have been spoken of. What position in the education of the children and what influence upon it did Israel ascribe to the mother? And what did they think of the education of girls? First of all we must frankly admit that the mother appears in only a single, and that a very obscure, passage as consciously participating in the education of the children. In the Proverbs of Solomon, there is to be found near the end of the book a little collection of sayings, xxxi. 1-9, with the special heading: The Words of Lemuel, the King of Massa, Which his Mother Taught him. Otherwise the mother is indeed mentioned along with the father, but always with the father and always in the second place. "Listen to the commandment of thy father and despise not the instruction of thy mother" (Prov. i. 8). And the following passage in Proverbs is especially characteristic: "When I was a son unto my father, tender and only beloved in the charge of my mother, then *he* taught me and said unto me" (iv. 3-4). Here, in poetic parallelism, the mother is mentioned first, one may say for propriety's sake, but after that she is utterly ignored: it is the father alone who teaches and educates. That this is nothing accidental is proved by the comparison of two very similar poetical passages, one German, the other Israelitish. We have a eulogy of the virtuous housewife in *The Song of the Bell*, and we also have one in the Proverbs of Solomon, xxxi. 10-31. Now in our Schiller we find directly that—

"She ruleth wisely
Her sphere of home,
The maidens training,
The boys restraining."

In the much longer Biblical eulogy of the virtuous housewife we find no word of this: she is depicted as one who takes excellent care of her husband and his household and keeps everything in the best condition,—but of the children and of her domestic control as mother, not a word! Toward the end, indeed, there is found the very beautiful expression: "She opens her mouth with wisdom and understandeth kindly instruction" (xxxi. 26), but this is put in very general terms and comes in quite incidentally. We meet here an undeniable and very surprising fact. Not, indeed, that the Old Testament is altogether lacking in appreciation of mother love. When, for instance, we read in the First Book of Samuel how Hannah, the mother of the prophet Samuel, visits her son, who is dedicated to the sanctuary, once a year at the time of the harvest festival in the temple at Shiloh, and brings to him a suit of clothing made by herself, it moves our heart to its depths. To express the highest degree of sadness the Psalmist says (xxxv. 14): "Like one who is mourning for his mother." Repeatedly the love of God is compared with the love of a mother, and perhaps nothing more beautiful and touching was ever written than the word of the Prophet: "As a man whom his mother comforteth" (Isaiah lxvi. 13). It is not, "As a son whom his mother comforteth," but "As a man." For even a man, proud and conscious of strength, has moments when only a mother can restore and comfort him.

If then, despite this warm appreciation of mother-love, the mother is slighted in comparison with the father in the very realm which our modern notion regards as her peculiar domain, we must assume that it was a conscious purpose in Israel that placed the education absolutely in the hands of the father, and we can, moreover, recognise this purpose elsewhere. It was desired that the training should be serious and severe, not the coddling of a "mother's pet," but a school for life, and this they felt could be better given the child by the father who knew life because he stood in the midst of it.

And certainly it would be very salutary for the present day if fathers devoted themselves more to their children and their children's education, and we must surely hold to this as an ideal re-

quirement. At the same time we will not forget that such conditions are possible only in a patriarchal state which knows nothing of special callings and professional work. It is a matter of course that we cannot demand of a modern father who labors day after day in his office or his counting-room all that was done and could well be done by the father in ancient Israel.

And what of the daughters? First of all I must discuss some passages of Luther's Bible translation where "daughters" are mentioned. In the so-called Sayings of Jacob, Genesis xlix., where Luther translated in the sayings about Joseph, "His daughters go about the management" (of the house?), ("Seine Töchter treten einher im Regiment"), this is simply a very queer misunderstanding of what is to be sure a very difficult passage, which is speaking of grapevines and not of daughters. And in the famous parable of the Prophet Nathan regarding the one lamb of the poor man, where it is said, "It did eat of his own morsel and drink of his own cup and slept in his bosom, and was unto him as a daughter" (2 Sam. xii. 3), this gives us the impression that it is intended to express a greater degree of tenderness than if it had said, "It was unto him as a son." But the lamb is in Hebrew of the feminine gender: the passage is strictly: "She was unto him," so that there was nothing to do but add, "a daughter." For our sense of language the only correct translation would be, "And it was unto him as a child." And when Luther translates in the eulogy of the virtuous woman, Proverbs xxxi. 29, "Many daughters bring wealth," many a Bible reader with a wealth of daughters may have shaken his head incredulously over the passage and thought to himself: that relentless realist Jesus Sirach certainly knew life better. For in an exceedingly drastic disquisition, much too drastic for our sensibilities, he shows that a daughter is a very questionable treasure which keeps the poor father awake of nights with anxiety (xlvi. 9-14). Now the passage in question in Proverbs of the many daughters who bring wealth, should read, "There are indeed many excellent maidens."

As to the education of daughters, there is in the entire Old Testament only a single utterance, and that in Jesus Sirach, but a

very striking one: "If thou hast daughters, train them to walk virtuously, and regard them not too tenderly. If thou dispose of a daughter in marriage, thou hast done a good work, but give her to a man of understanding" (vii. 24-25¹). That is all that we have on the subject! Of course the religious instruction was given to the daughters also, yet in addition they received instruction in domestic work, which of course was taught by the mother.

But as for education in the special sense of the word, viz., writing, reading, and arithmetic, we have neither direct nor indirect information on the subject. For even though Queen Jezebel in the familiar account of Naboth writes a letter to the elders of Jesreel and seals it with the seal of King Ahab (1 Kings xxi. 9), we cannot conclude from this alone that girls in general could read and write. And we have a classic illustration of the view of the later Orient on this subject. An exceedingly popular variety of literature is what is known as the literature of apothegms, in which are collected maxims, opinions, sententious sayings of famous men, chiefly Greek philosophers. These apothegms are found throughout the entire Orient in translations and the greatest variety of versions so that we may fairly regard their contents as typical. And among these apothegms the following story is told of the philosopher Diogenes: Seeing one day some one teaching a girl to write, he said, They are dipping her arrows in poison! That means a vigorous and thoroughgoing hostility to all feminine education, and this the Oriental clearly regarded as wise and correct. For the Oriental has never been able to rise to the recognition of the equal rights of man and woman, or even of an equal humanity in them. And in this respect the Israelite is Oriental. In the Talmud we find three times the saying: "Well for him whose children are boys; woe to him whose children are girls!" In the Old Testament there is indeed nothing like this directly expressed, but without doubt this is what the Israelite of old thought.

The Koran also furnishes instructive material on this point. The heathen Arabs worshipped chiefly three feminine divinities,

¹ In Luther's Bible verses 26-27.

who are called daughters of Allah; for they were fond of conceiving all higher powers as feminine. Mohammed attacks this habit of thought with the following drastic *argumentum ad hominem*: "Is it not true that ye wish to have sons; and should God have daughters? And if the birth of a daughter is announced to one of you, then his face is o'erclouded with trouble, and he suppresses his desperation only with difficulty, and hesitates to appear in public because of the bad news that has come to him, and he is in doubt whether to bring her up to his own disgrace or rather to bury her in the earth!" (Sûrah 16, verses 59-61). The exposure and murder of newly-born girl children is of course a widespread custom, of which the prophet Ezekiel must have known, for in the famous sixteenth chapter of his book he describes Jerusalem as a new-born, castaway Bedouin girl, that lies moaning and weltering in its own blood by the wayside, where God finds it and takes it up, and then tends lovingly and rears to maturity. Not that Ezekiel meant to ascribe such an abominable practice to the ancient Israelites, for he says too expressly, "Thy father was an Amorite and thy mother a Hittite."

But in the passage cited, Mohammed speaks of burying in the earth, and on this point our information about the ancient Arabs furnishes us a horrible illustration, for there was among them a custom which is even not lacking in a certain grim humor and probably presents in its unqualified brutality the most peculiar of all solutions of the woman question. If casting away in infancy did not accomplish the desired result, and if there were still too many girls in the community, then the fathers took the unmarried daughters, decked them as brides and buried them alive. That is the Oriental conception of the inferiority of women, who were really regarded merely as a necessary evil. And in this point Israel did not wholly break down the Oriental barrier, and indeed it did not actually accept the complete religious equality of men and women.

Attention has often been called to the fact that in the priestly regulations of Leviticus the priest is forbidden to defile himself by contact with the corpse of his wife; that is, to perform the funeral lament for her; at least, in the evidently very accurate list of the

persons for whom he may perform this service the wife is lacking (Lev. xxi. 2-3). Judaism also regarded the man as the sole bearer of religious worship. The main space of the synagogue is used exclusively by men, while the women, concealed in the balconies, are spectators rather than participants in the worship. The obligation which rested upon every mature male Israelite of reciting twice a day the so-called *schema*, the elemental confession of Judaism is expressly designated as not valid for women in a Mishnah of the treatise *Berachoth*, and since the man thanks God expressly in the daily prayer that he was created a man, of course man and wife cannot even pray in concert. Hence we need no longer be surprised if we find in the Old Testament nothing of the education of girls.

Let me sum up. The ancient Israelitish family was an absolute monarchy based upon obedience, and the father the absolute monarch in it. The education of the children also lies entirely in his hands. Training is strict, even harsh, the fundamental element of it being religion and its principal aim the development of a religious personality. Even the school instruction was given at home and by the father; whether the daughters received any share of it we do not know.

These views precisely reverse everything that we regard as natural and a matter of course. What then shall we think of them? They are certainly not the final word on the subject; the gospel of the freedom of the children of God, in which there is no distinction of male and female, is higher. But let us not on that account despise them; for they served their purpose, they stood the fiery test in a very literal sense. If Israel has successfully outlived all its persecutions and all the blows of fate, this has been possible only because every individual household constituted a compact unit, which might be destroyed but not broken up. And although much about this institution, even perhaps the whole of it, fail to secure our approval, yet I would like to call attention to one very cogent fact. Our kindred nation in distant South Africa, whose heroic struggle for its freedom and existence has for nearly three years kept the whole world that has any heart in a fever of hopeless hope, is a

shining illustration of the Old Testament sort of education. The Boers, with their childlike trust in God and their naïve belief in the Bible, with their patriarchal conditions and their old-fashioned institutions, are in the very depths of their nature an Old Testament people. And what applies to the Boers holds good for Israel. The Old Testament sort of education trained men and heroes, perhaps not always lovable and sympathetic, but whole men, armed for the battle of life and steeled for martyrdom, greater heroes perhaps in suffering and enduring than in action. An education that can show such results and upon which the blessing of God rested evidently for so many thousand years, may certainly command our admiration.

CARL HEINRICH CORNILL.

BRESLAU, Christmas, 1901.

THEOLOGY AS A SCIENCE.

PART II.

THE HAECKEL-LOOFS CONTROVERSY.

THEOLOGY has recently become a science. The idea of God is being purified on a philosophical basis and is fast becoming a term that will no longer give difficulty to the scientist, while the Bible is being investigated with a critical earnestness with which no other book has ever been studied. At the same time, comparative religion is giving us a better comprehension of our own faith and religious sentiments.

A century ago great disasters, such as hurricanes, volcanic eruptions, earthquakes, etc., gave rise to theological discussions in which the representatives of all creeds endeavored to show that there was no conflict between God's omnipotence and omniscience on the one hand and his omnibenevolence on the other. The young Goethe was still overwhelmed with the problem of the earthquake of Lisbon, as can be seen in his autobiography, and he found no satisfactory solution of it in the traditional conception of God. In our present age the latest outburst of Mount Pelée has wiped many thousands of people out of existence in the most horrible manner by suffocating them with obnoxious gases and covering them with a hail of fire. The tragedy on Martinique with a criminal as its sole survivor must have been more horrible than the catastrophe of Pompeii and Herculaneum, and worse than the earthquake of Lisbon! Yet no theological discussions were raised either in the papers or in the pulpit. No questions were asked in public as to the goodness of God. There was no excitement about it of a reli-

gious nature, save the sympathy expressed by sending help and taking care of the unfortunates that were still alive in the ruined island.

The true reason of this change must be sought in the fact that to the thinking part of mankind the problem has been solved. There are some left who do not as yet know of the new conception of God and still cling to their anthropomorphic views, but even they have their misgivings about it, and so keep quiet. Even they know that the laws of nature are irrefragable and that the old notions of providence, being no longer tenable, must be replaced by a new doctrine which holds that providence is immanent in man and that man must work out his own salvation.

There are to-day more avowed atheists than ever, and the theists are divided among themselves. Some believe in a personal God who has theoretically all the power of an autocratic ruler, but in their inmost hearts they concede that he has virtually abdicated in favor of law and so can no longer be held accountable for the various accidents that befall mortals. Others have more or less identified God and law and are thus approaching every one in his own way a scientifically tenable conception of God.

A few years ago when a storm happened to sweep over the Atlantic threatening to sink an ocean liner on which the Rev. Mr. Moody had sailed, a frivolous reporter interviewed the pious preacher, the captain, and many of the passengers as to their belief in the efficacy of the revivalist's prayer on that occasion. Moody refused to answer the question, for even with his child-like faith he saw that however he might represent his views there was little chance of making converts, and the reader could see a sort of grim humor in the report of his few remarks, which were published without invidious comments and with strict impartiality.

It is natural that in the excitement of danger people of Mr. Moody's education and disposition should implore God's mercy, but we no longer blame the captain if he has no confidence in the efficacy of prayer. Whatever the captain believes, we expect him to keep his head clear and to take the right measures to save his ship. Prayer is recommendable if it has that effect upon his mind.

If prayer were truly a reliable method of commanding the wind and the seas, navigation companies would not fail to engage men that could pray and send them out on dangerous sea voyages. But the old belief in this external and pagan conception of the efficacy of prayer has become a mere student's joke even in the good university of Oberlin, where it was said that when a certain celebrated divine prayed it sprinkled, but that when old Dr. Finney, the pious and militant theological president prayed, it *poured*.

The Pelée disaster was too terrible for frivolous comments, and so all religious discussions were hushed by the seriousness of the occasion.

Only later did the papers publish a few extravagant utterances, from which I select one which comes from the island of Martinique itself.¹ Père Marcy, the Curé of a church at Morne Rouge, denounced the inhabitants of St. Pierre for Satanism, renewing the old exploded charges of Leo Tàxill and the mythical Diana Vaughan, exclaiming with a shudder: "You have no conception of what went on in that wicked city! The Satanists and their black masses, the terrible people who worshipped the devil and made their horrible offerings to him, were not the only ones whom God punished. . . . Poor souls! They had not even time to repent of their sins."

Such views are mere survivals and are considered curiosities of antiquated bigotry and ignorance.

This change of conduct indicates a radical change in the religious attitude of the world,—a change which from the old standpoint may be characterised as a drifting toward infidelity, but which is simply the progress of a scientific conception of the world. Science has added to our knowledge and is just about to modify our religious faith. We cease to be children and approach the age of maturity. We put away childish things and grow in comprehension. There are many, perhaps, who are not yet clear as to what the new God conception is, but most of them instinct-

¹ See the St. Louis *Republic* for Sunday, July 13.

tively feel the change, and their thinking and doing is influenced by it without their knowing it.

The transformation of the old theism into the new conception of God may be fairly compared to the progress of science from alchemy to chemistry or from astrology to astronomy, and so we have proposed calling the new theology THEONOMY, as being a genuine science in contrast to the old theology which was based upon erratic notions, guesses, and prophetic dreams.¹

The errors of the old theology are like the heads of the hydra; when lopped off they grow again in greater numbers. Accordingly it is dangerous to fight them in open battle. There are some theologians who still believe in the old views; they distrust the progress of science and continue to hold back, but their ranks are beginning to grow thin. Others seek refuge in agnosticism. A few take their cross upon them and tell the straight truth. They may be honest, but they are not wise. So far a certain percentage of them has been tried for heresy, found guilty, and dismissed. Most of the theologians who know the truth and have found the solution, break it to the world gently, confining their efforts to the education of a new generation that will be better prepared for the problems of the present age and will no longer shrink from recognising the rights of science. These employ methods that promise success, but they have developed a new language and new modes of speech which none but the initiate understand in their full significance. They speak the truth, but they express themselves in terms which do not state but merely involve the result; or whenever results are given direct, their negative side, which discredits the old theology, is only indicated, while the positive aspect is emphasised with great energy.

Among these theologians there are plodding investigators, men of deep conviction, who have had in their own hearts to overthrow the idol which they worshipped. They know what a hard struggle it is to break away from the old traditional interpretation of religion and the child-like trust in the letter. And, now, in for-

¹ See *The Monist*, Vol. XII., No. 4, p. 561.

mulating their new views, they stop to consider the sentiments of their brethren who have not yet reached the same stage, and from sheer charity couch their statements in guarded terms and express themselves in words that will give no offence to those who are still babes and should be fed with milk only.

* * *

Charity in theological discussions is a new feature which corresponds to politeness in the realm of the other sciences. The old theology, like astrology, is distinguished by a certain vigor of expression, which rarely hesitates to show its firmness of faith in denouncing all other views as heretical.

Swearing in society is regarded as improper, but it was the style in the old theology. And the damnation of heretics is still the favorite method of settling theological disputes in the most conservative and venerable Churches. Tolstoi has had his experience of it, and Protestants even to-day are officially cursed once a year by Rome, while the Protestant confessions of faith still contain denunciations of the Pope as Antichrist.

There is no need of our denouncing, ridiculing, or vituperating the old method of settling disputes in theology, and we make reference to it without any animosity, simply characterising it as typical of a certain age of our religious development. In its time it was as natural to the Church as are childish pranks to children. The churches have outgrown it to a great extent, and will outgrow it more when, on their approach to maturity, following the prediction of St. Paul, they will put away childish things.

The fanaticism of the old Church indicates the fervor of the religious sentiment, and although the consequences are very sad when we consider the fagots of the inquisition, we need not dwell on the dark side now but may rejoice that the times have changed. We must understand, however, that the approach of science is the abolition of brutality in enforcing the truth of a proposition. The man who can prove his views by rational arguments never uses threats. Accordingly vigorous terms in upholding a proposition appear in inverse ratio to its being supported by scientific argu-

ment. Thus the more a science has reached the stage of maturity, the politer are its representatives in their discussions of mooted subjects. Mathematicians are in the habit of simply pointing out the mistakes of their colleagues. They never revile one another, for arguments are sufficient, and so they can afford to behave like gentlemen. In the measure that there are no arguments forthcoming, scientists feel constrained to make up for the deficiency by vigorous expressions denouncing as an ignoramus any one who ventures to differ from them. Thus even mathematicians, in trespassing upon the domain of metaphysics in building its metageometrical air-castles, occasionally assume the theological style. Discussions of the natural sciences, when their devotees make raids into the unknown territory of hypothesis and theory, are by no means free from personalities and invectives, still they are moderate when compared with the controversies of philosophers with their denunciations and self-glorifications. Think of the self-sufficiency of the Hegelians in Germany and witness the tirades of Schopenhauer! He had no arguments to offer; so he hurled at his *confrères* who at that time were in possession of almost all the professional chairs, the thunder of his displeasure. In the measure that philosophy becomes a science, its representatives cease to use epithets.

The climax of vigor in the assertion of a position without argument is reached in the domain of religious dogma; and we will not think the worse of the theological scholars of past ages when we consider that in their dearth of rational argument invectives and interdicts, excommunications and heresy trials, and sometimes even fire and sword, were the only weapons that could be had. If we tolerate Schopenhauer, should we not also have some consideration for the popes who are surrounded by mediæval traditions? Their thunderbolts are blunted, and the days of massacres of St. Bartholomew are past. We need not forget, but we can forgive; for we have learned to appreciate the psychology of fanaticism.

The time has come when theology itself attains to maturity. It is fast becoming a science; and in the measure that it becomes a science theologians will cease to excommunicate heretics and intro-

duce a new spirit into their discussions which is less vigorous but more polite, more considerate, more charitable.

It may appear that the abolition of vigorous terms in the domain of theology will make of it a namby-pamby science without character. But such is not the case. Argument, the new weapon, is as much more formidable than the fagot in destroying errors and in eradicating heresy, as the rifle is superior to the ancient cross-bow and the cannon to the club of a savage. It is mere euphemism when we speak of the old methods of theological discussion as "rigorous," for we are fully aware of the power that scientific argument carries. Though modern scientific discussions are couched in polite language they are incomparably more formidable than the weapons of modern warfare, and will brook no resistance. Science gives every one, every institution, every faith, every man in his station a chance to conform to its revelation, but it will slowly yet surely crush anything that persists in opposing it.

* * *

In speaking of theology as a science, we ought not to pass over in silence an incident which made a great stir in the scientific world, and which, though of a personal nature, is of general interest as characterising the period of transition—viz., the case of Loofs *versus* Haeckel. The contrast is overdrawn and the literature on the subject distorts the picture of the situation, but it will for this reason serve all the better to point out the true relation between natural science and theology.

Professor Haeckel is a naturalist, not a theologian, not a philosopher, not a historian. But being a man of deep emotions, he is enthusiastic in whatever he does, he is zealous in whatever cause he espouses, and would be called intensely religious were not his religious ideal opposed to old established religious institutions. It is but to be expected of a man of Haeckel's type that he should have artistic talents; he paints and has as keen a sense for beauty as for poetry. In natural science he rises mountain high above the average naturalist, and his peculiar field is an almost prophetic comprehension of the significance of the facts which mark the pro-

cess of life in its successive phases. It is not an accident that his nomenclature, words like "ontogenetic" and "phylogenetic" and a host of other terms, has been universally accepted by naturalists, but it must be regarded as an evidence of Haeckel's genius for finding the characteristic feature that needs determination and for describing it clearly and unmistakably by a single word. Haeckel's greatness is due to his clearness, and his fame is founded on his penetration in tracing the simple laws that rule complicated phenomena.

This sense for the recognition of the simple which Haeckel manifests, is at bottom a moral quality. He who knows Haeckel personally will gladly agree with me that he is without guile and as simple as a child. He makes no pretensions; he does not bluster or make a show; he neither seeks nor makes complications. He is direct in all he does, and in all he thinks, and in all he writes. This directness is peculiarly his when he observes nature; this directness appears in the style of his books, and this directness makes him openly blunder when he is mistaken; but this directness is simply a child's love of truth. Though Haeckel does not call himself a Christian, he is truly possessed of that child-like spirit which Christ declares is indispensable for the attainment of the Kingdom of God.

Professor Haeckel has written a book entitled *The World-Riddle*, which was a great financial success, but it became the butt of all his adversaries, theologians, Protestants and Roman Catholics, dualists of every stripe, and also philosophers and their ilk. Much of this criticism is perfectly true and may be granted in advance. Many most essential tenets in Haeckel's philosophy are thereby rendered irrelevant or antiquated, but that proves nothing against his peculiar significance in modern thought as a prophet in the field of natural science; it proves merely (as stated above) that he is not a theologian, not a historian, not a professional philosopher.

Although I consider myself a personal friend of Professor Haeckel, I by no means accept his formulation of the Monistic conception. I have had discussions with him in both *The Open Court*

and *The Monist*.¹ He made his statements and I my counter-statements, but he has always regarded the differences as trivial and purely verbal. Instead of discussing the differences, he simply wrote in a private letter: "We mean the same." Now that may be perfectly true, simply because Haeckel deems it necessary to negate certain theological claims, while I endeavor to point out the religious significance of the facts of life. He sees the latter as well as I, and I agree with his position as regards the former; but he slurs over the latter, and I deem the former antiquated. In the field of science there is nothing more important than the religious significance of scientific truth; and on the other hand, in the realm of Church life nothing is more important than the *résumé* of scientific results that affect the traditional religious belief. Hence it is natural that Professor Haeckel's religious views should have caused quite a stir in the world. He has been attacked not only by theologians, but also by philosophers. At present we are interested in the theological issue of Haeckel's position, and will therefore limit ourselves to a few comments upon the formidable onslaught on Haeckel's book *The World-Riddle*, made by Friedrich Loofs, Professor of Church History in Halle.

Professor Haeckel's *World-Riddle* is less scientific than religious, and considering his position in religion and his negative attitude in theology, the book is strong in the criticism of antiquated views and wanting in building up a new theology that would accord with natural science; and this weak point has been discovered by many theologians, philosophers, and historians, and the result has been a general attack upon our famous friend, executed with remarkable unanimity as if by general order. Here was a chance to take the scalp of a famous naturalist, and many a puny knight ventured forth to meet the giant and have a fling at him, in the hope of becoming a second David.

¹ See for instance "Monism and Mechanicalism, Comments upon Prof. Ernst Haeckel's Position," in *The Monist*, Vol. II., pp. 438-442; "Professor Haeckel's Monism," *ibid.*, Vol. II., pp. 598-600; "Professor Haeckel's Panpsychism," *ibid.*, Vol. III., pp. 234-242; "Professor Haeckel's Monism and the Ideas of God and Immortality," in *The Open Court*, Vol. V., No. 212, pp. 2957-2958.

Professor Loofs is one of these would-be Davids. He put on the royal armor of science, but it proved too heavy for him, so he preferred the sling of abuse and attacked Haeckel in the vigorous style of ancient theology by calling him names.

Now, we know little about Professor Loofs's accomplishments. Upon the whole, he seems to be a fairly well-established representative of modern theology, though he is not a star of the first magnitude. He is a scholar and is apparently imbued with the spirit of science. But he does not conceal the irritation he feels when contemplating the recognition which is accorded to the natural sciences, and he chafes at the thought that the public at large as yet know nothing of the latest developments in theology. Even men of fame know nothing of it, and the time seems to have come for a doughty knight of divinity to have a tilt with one of the naturalists and prove the valor of the theologian in the domain of science.

Now, Haeckel claims that the miracle of the immaculate conception is untenable, and venturing in a footnote upon the historical field incidentally makes the mistake of treating an old Jewish insinuation, that Jesus was of illegitimate birth, as a historical document of credence. Professor Loofs did not let the opportunity slip. He addressed Haeckel in a private letter first sarcastically but politely, then in a public letter in most insulting terms, with the outspoken hope that Haeckel would sue him for abuse. A law suit of that kind would have engaged public attention, and Professor Loofs's name would have appeared in all newspapers. Haeckel, however, did not gratify Loofs's wish but referred him to his authority, Saladin.

Now, Saladin is the pseudonym of W. Stuart Ross, a Scotchman, who began his career as a student of theology but turned unbeliever and is now editor of the *Agnostic Journal* and one of the most noted freethinkers in London. Haeckel, who is quite ingenuous in matters theological, spoke of Saladin as "a prominent English theologian," and so furnished more grist for the mill of Professor Loofs.

Professor Haeckel can scarcely have read Loofs's expositions, for he (not being in the habit of writing between the lines) is still

less accustomed to read between the lines, yet this is an art which has attained a high development in modern theology. Probably Haeckel did not even read Professor Loofs's letters, and so, assuming that his critic believes in the supernatural conception, refuses to enter into a controversy with him. Here Loofs finds another weak point. He accuses Haeckel of dishonesty, for Loofs insists that Haeckel's negligence is intentional.

In our opinion there is no question but Haeckel's oversight is due to carelessness, and not to dishonest misinterpretation, for what a chance did Haeckel miss in not requesting Loofs to state frankly and in unequivocal terms whether or not he believed in the natural birth of Jesus!

Professor Loofs (another Herostratus) was bent on acquiring notoriety, and so he took opportunity by the forelock and again rushed into print, this time in a pamphlet under the title *Anti-Haeckel*, in which he triumphantly displayed the scalp of the famous naturalist.

The situation is humorous and would afford good material for the cartoonists of *Puck* and *Life*; but we will forbear entering into details and discuss only such points as possess a significance beyond themselves.

The soil on which our David met his giant adversary (viz., ancient Jewish traditions) is slippery ground and all but inaccessible to common mortals. Its topography is known only to a few rabbis of Poland and Germany who have been reared from babyhood on the milk of Talmudic lore. It is a matter of course that Professor Haeckel is not at home here and to take him to task for being ignorant as to the literary significance of a reference to the *Sepher Toleoth* is as much justified as if Haeckel found a flaw in Professor Loofs's knowledge of some obscure detail of the natural sciences, say on the subject of parthenogenesis which in certain families of the lower species is not a miracle but an established fact. But unfortunately Professor Loofs, in spite of his theological education, failed to prove his point and gave evidence only of his ignorance in this special branch of learning. Dr. Erich Bischoff, the editor of the *Christliche Welt* in which Loofs published his open letter to

Haeckel, proves that Loofs's counter-proposition is untenable and that even his statement concerning the synodicon as to the established canonicity of the four gospels at the Council of Nicæa cannot be relied upon. But that is incidental and we do not intend to enter into details, though it ought to have taught Loofs charity toward others.

One point is of special importance; it is this: On close inspection it appears that both parties agree much better than Professor Haeckel is aware of. Professor Loofs seems to believe as little as Professor Haeckel in the virgin birth of Jesus, but while the latter makes his statement in the directest possible way, saying that he being a natural philosopher does not believe in miracles, Professor Loofs is more circumspect and makes no definite statement. The conclusion at which he arrives is written between the lines.

Professor Loofs insists that he attacks Haeckel on account of "his vigorous hatred of Christianity and his lack of appreciation of Christian faith and morality;" he speaks of his "arrogant ignorance" (*anmassliche Unwissenheit*), but expressly denies that the historicity of Christ's virgin birth is the issue of the controversy. As to the latter, Loofs points out that "there was an ancient tradition in Jewish-Christian circles according to which Jesus was regarded as the son of Joseph";...and "it is not an arbitrary proposition to represent Math. i. 18 ff. and Luke ii. 1 ff. as belonging to later strata of Biblical tradition...." However, dogmatic arguments in favor of the Parthenogenesis cannot stand...."There is no reason to understand why a natural birth in the conception should be different from a natural growth," etc., etc.

I have no inclination to argue with Professor Loofs; he might write me a letter similar to that which he wrote to Haeckel. So simply state a few of his arguments to show the logic of his argumentation. Dr. Bischoff, who seems to possess the tact to find the proper word at the right time, adds that Mary's psychical virginity is more significant by far than the miracle of a supernatural conception. But we might suggest to Professor Loofs that the literary arguments of the Church historian which are supererogatory

to scientists like Haeckel, have no weight with people who accept miracles, and must appear flimsy to a staunch believer.

* * *

The case Loofs *versus* Haeckel is a spectacular side-show, which is as interesting as a burlesque written in travesty of a serious drama. While it discloses foibles in both combatants, it indicates that the times have changed. There is now a theology that has become a science, and natural science has become one of her most powerful allies.

We know now that all truth is divine and God reveals himself in natural science as well as in history. The most significant lessons for religious purposes are the facts of man's life; his sorrows and temptations, his bereavements and his final destiny in death. His spiritual growth is recorded in the development of the race and has found classical expression in the sacred books of the several religions. The duty devolves upon us to study these documents of man's religious life, to collate and compare them and thus understand their significance in the religious evolution of mankind. A literal acceptance of the Bible and of the dogmas in the symbolical books is as pagan as was the ancient belief in Greek mythology. A genuine Christianity and a scientific theology (viz., theonomy) became possible only through the overthrow of the paganism that still clings to the traditional interpretation of religion. So far the new theology has plodded on in modest obscurity, but the time has come when what scholars whisper into each other's ears will be preached from the housetops. It is an open secret, generally recognised though little talked about, that the new theology exists and is in a quiet way working out a most important reformation in our religious life, and this reformation is mainly concerned with the intellectual side of religion and insists on scientific honesty.

Do not blame the new theology for its reluctance in speaking out boldly and bluntly, for there are many things that, though true, would, under certain conditions, if uttered brusquely, be positively injurious, and indeed, if expressed without propriety, even wrong and false. We cannot recommend Professor Loofs's methods. In his theological articles he uses the language of the new theology,

speaking by indirection, but in his controversy he follows the vigorous methods of the old theology, heaping abuse upon the head of his adversary. While his example ought not to be followed, we appreciate highly the tact of the genuine theologian.

There is no need of either letting truth ostentatiously go naked or of hiding her form in the drapery of hypocrisy. Discretion is her most becoming garment.

If Professor Haeckel had known that his theological adversary absolutely disclaimed defending the supernatural birth of Jesus, nay more, that on close inspection he was even guilty of not believing it himself, and that his notion of miracles was diluted by philosophical considerations, he would have been bewildered, for he takes the supernatural birth of Jesus to be the issue of the controversy. If Haeckel had been aware of the fact that Professor Loofs censured him merely for a lack of judgment as to the historical unreliability of certain references in the Talmud, made in an incidental footnote, he would have exclaimed: *Pourquoi tant de bruit pour une omelette?*

EDITOR.

THE PROBLEM OF ATTENTION.¹

I.

I AM looking at the flowered pattern of the paper on the wall in front of me. I see the intertwining of the stems, and the outline of flowers and leaves; I am conscious of the differences in color and brightness within the pattern itself and between it and the uniform background. All these details come out with perfect clearness at the spot upon which my gaze is directed. It is true that this spot is of no great size; its diameter, as I sit at a distance of one meter from the wall, is only some six centimeters. Around this spot I notice that the flowered pattern loses in clearness, at first slowly, then more and more quickly, until I reach the limit of my field of vision, and cannot make out any pattern whatsoever. If I did not know that the whole wall is covered with the same paper, I should suppose that the paper-hanger had chosen less and less pronounced patterns, the farther he moved from the point upon which my eyes are fixed, until finally all pattern and color were lost in an indifferent gray.—In this description I have, of course, assumed that the eyes do not move.

I am short-sighted, so that I cannot see the pattern clearly unless I wear glasses. If I take them off, the part of the pattern directly before me looks like the part of the wall that I saw just now round about the point of regard. The contours are indistinct and the details are blurred. The books, placed a little further below, have their titles printed on the covers in large black letters. I am now unable to read them, and my eye must approach consid-

¹ Translated by Professor E. B. Titchener, Cornell University.

erably nearer to recognise the words without glasses. The two differences of distinctness, hitherto mentioned, are known to depend on the peripheral organisation, i. e., on the mechanism of the sense-organ, the eye. The retina, on which the objects of the external world must project their images in order to be perceived, has at its centre a depression known as the point of clearest vision. The light-perceiving elements are here set most closely together, and thus make possible the most exact representation of the outer-world. Beyond this depression there are interstices between the elements; they increase with the distance from it, and we lose accordingly first the finer and then the coarser differences in the form of the retinal images; till at last all details disappear in a confused general impression. And again, the rays of light proceeding from a luminous point in the outside world cannot be reunited at a single point on the retina, unless the lens of the eye have the appropriate focal distance, which can be varied within certain limits by what is called the mechanism of accommodation. Beyond these limits, which for the short-sighted eye are extremely narrow, the images of luminous points in external space are not themselves points but circles, "dispersion circles" of greater or less diameter. Consequently, objects which lie at a distance for which accommodation is impossible are seen hazily and indistinctly.

But there may be still other reasons for the indistinctness of the pattern of my wall paper. If, e. g., I am blowing a cloud of smoke from my cigar, and the smoke floats up between my eye and the wall, I see the pattern dimly as if through a veil. So, on a foggy day, I may adjust my eyes as accurately as may be; but I shall not make out a single detail of the mountains among which I stand. I can hardly distinguish the line of division between them and the horizon. The production of this sort of indistinctness, which evidently depends upon objective conditions, is a problem in physics. It lies altogether beyond my power or volition. The production of the other two forms of indistinctness, on the contrary, is a problem in physiology. The differences in visual perception are conditioned upon certain peculiarities of the sense organ,—upon a change in the structure of the retina, and upon the

range of accommodation. But, here as before, our mind is not directly responsible for them. Their conditions are to be sought, not in any attitude of mind, but in the eye. So that distinctness or indistinctness of vision, as we have spoken of the matter hitherto, is not brought about by any mental state or mental process, and is innocent of any psychological significance.

We may, however, take a fourth instance of difference in clearness of vision, which will lead us to a very different conclusion. I take my seat once more, and direct my gaze upon the pattern before me; but as I look, my mind is busily engaged upon a scientific problem. I am reviewing in thought the controversy that has recently arisen regarding the aims of historical research,—balancing the pros and cons, wholly engrossed in the one train of thought. When I try subsequently to call up the impression that the pattern made upon me, as I sat thinking, I have to confess that at best I had only a fleeting glimpse of it, now distinct and now indistinct, and that there were times when I did not see it at all. Yet my eyes were kept constantly open,—apart from momentary interruptions by winking reflexes,—and were directed steadily upon one and the same spot. It is clear that, in this case, there can be no question of differences in objective clearness. Neither can this new observation be adequately explained by appeal to the peripheral or physiological factors. It may, of course, have happened that my eyes slipped a little, without my knowledge, from the exact point of fixation, or that there were slight changes from time to time in the state of accommodation; but it is obvious that occurrences of this sort cannot bear the full burden of explanation. On the contrary, I am very sure that my mental state at the time of observation, my intensive occupation with a definite train of thought, rendered it difficult or impossible for the visible object to gain access to consciousness.

Other instances may be adduced in proof of this influence of state of mind upon sense-perception. I do not hear the noises in the street, when I am entirely absorbed in work, although the objective and peripheral conditions for their perception are fully realised. My student lamp has been smoking for some time; but I did not

notice the fact until the smell had become so strong as literally to force itself upon consciousness. Now I have suddenly become aware of it, in a very unpleasant way. Again, my secretary is reading aloud to me. As I listen, I begin to think of something that I mean to do in the near future. When I have worked out my plan of action, I come back to the reading, and am made aware that I have lost some part of it; I cannot bring my knowledge of the subject-matter into relation with the words that I now hear. While I was occupied with my plan, the tones of the reader's voice, which I seem to have followed without interruption, were empty, meaningless sounds. Once more, we are listening to single notes played upon some musical instrument, piano or violin. The science of acoustics declares that these single notes are not simple tones, but consist of a fundamental tone and of certain overtones, whose character depends upon the nature of the instrument. If we have had practice in the analysis of these notes, we are able to 'hear out' the separate overtones, besides hearing the fundamental. But, again, it depends upon a peculiar mental attitude, or state of mind, whether we hear or do not hear the overtones. We may address ourselves to the note as an undivided whole, in which case its partial tones escape our notice.

These facts, and others like them, furnish the basis of the notion of *attention*. We say that it depends upon the attention whether sense-impressions—visual, auditory or what not—come to consciousness, or whether the details of a picture or the constituents of a note are made out or discriminated. And in saying this, we think of the attention as a state of mind which may be realised in greater or less degree, and may embrace at any given time a larger or smaller number of conscious processes. Having regard to the varying depth or intensity of attention, we ascribe to it the attribute of *concentration*; this we take to be greater, the more difficult it is to divert the attention from its present object. Having regard to the multiplicity of contents upon which it can fasten, we speak of various *directions* of the attention; thus 'local' attention is an attention directed upon a particular point in space. Further, in view of the variable number of objects with which the attention may be

distinctness of the observed impression—may, within certain limits, be weakened or even abolished, though not without especial pains and practice. We are able, with a certain effort, to bring the objects seen in indirect vision to the forefront of attentive observation. One sometimes meets people in society who possess this power in a marked degree. While their eyes seem to be gazing steadily at what is in front of them, they are secretly alert to what is happening on either side. But this sort of incongruity between central and peripheral distinctness is, of course, impossible save in cases where the physiological mechanism is directly controlled by the will. Movements of the eyes are voluntary; change of accommodation is not. Hence we cannot break down the natural connection between accommodation and attention unless we direct our gaze upon an object which is not the object of attention, or attend to an object that lies outside the range of accommodation.

Vision is not the only sense-department in which these peripheral changes of distinctness occur. If, for instance, we are seeking to identify an odorous gas, we make a number of short, sharp inspirations: we 'sniff' at the flask. And again, to bring out a taste distinctly, we make certain movements with the tongue, whereby the stimulus that we are examining is crushed and diffused. It is, indeed, a general rule that peripheral distinctness and central distinctness go hand in hand; and it is not easy, without special investigation, to say how much of the total effect is due to the one factor and how much to the other. We run a very real danger of ascribing to attention, i. e., to a determinate mental state or attitude, results that are actually conditioned upon the special adjustment of the sense-organ concerned.

There is a further difficulty. If we are to have any exact knowledge of the degrees of consciousness, we must be able to vary them at will. In other words, we must be in a position to induce, at our pleasure, this or that grade of psychophysical distinctness, as independently as may be of all extrinsic influences. Experience shows that there are but two ways, in the normal waking state, by which this end may be accomplished. We may either

distract the attention, or we may divide it. Now distraction of the attention, in the strict sense of the term, means the inducing of inattention, i. e., of the lowest degree of consciousness; so that, if we are to obtain any other grade of psychophysical distinctness, we must have recourse to a division or distribution of attention. But again, when we have reduced a given degree of concentration to a lower level, by this division of attention, we still have no standard by which we might measure the change of consciousness. For, as was said just now, the distribution of the activity of attention may be anything but uniform. As I listen to an opera, my attention is held, first and foremost, by the scenes that are enacted upon the stage and by the voices of the performers, while the music of the orchestra recedes into the background. But this attitude of mind need not persist; in scenes where the plot moves but slowly, it may be entirely reversed. In this, then, as in many other instances, there can be no question of a really uniform distribution of the energy of attention.

Furthermore, the power of a stimulus or an occupation to distract the attention does not remain constant. If it is often repeated, we grow accustomed to it, and have little difficulty in meeting the demands which it lays upon us. It thus gradually loses its original power of dividing or diverting the attention. It is clear that, if we are to induce a determinate degree of consciousness, we must know, first, the mode of distribution of the total energy of attention over the separate conscious contents included within its range, and, secondly, the distractive value of the process which we have selected for our purpose. Now no general rule can be laid down under either heading; the results that have been obtained hold only in particular cases; so that, from this point of view also, the investigation of attention is peculiarly difficult. So much we may say, and no more: that the distribution of attention brings with it a reduction, and concentration of attention an enhancement, of the degree of consciousness for a determinate content. Psychologists have not yet attained to any quantitative formulation of these changes.

There is still a final obstacle to the systematic treatment of the

occupied, we speak of its *distribution* as well as of its concentration. The distribution of the energy of attention, i. e., of its degrees of concentration, may itself be either uniform or variable. Lastly, we contrast attention with *inattention*, which signifies either a total lack of concentration or distribution, or at any rate a lack in some given direction; and we recognise in distraction a special form of inattention, a 'scatter-brained' state which manifests itself characteristically in inappropriate remarks and unsuitable actions.

Popular psychology, which perhaps found its most faithful expression in the experience-psychology of the eighteenth century, confuses in its idea of attention three very different notions: that of a *faculty*, the operation of which produces certain changes in the mental life; that of an *activity*,—the activity of remarking, noticing, observing,—always directed upon some definite content which is the immediate occasion of its exercise; and, lastly, that of a *state*, in which we continue for a longer or a shorter time, unaffected by changes in the contents of our consciousness. State and activity are alike conceived of as the effects or manifestations of attention in its first meaning, as mental faculty. That the same name should be used to designate both cause and effect is nothing unusual in 'common sense' psychology. The term 'will,' for instance, signifies on the one hand a faculty, a capacity for a considerable number of actions that are in certain respects alike, while on the other it denotes the individual act proceeding from this faculty. Nothing more could be said of the 'faculty' than that it is a cause, residing in the subject himself, of the occurrence of certain mental phenomena; and with such a definition there is nothing strange in the use of the same word for both cause and effect. We find precisely the same thing in physics. The word 'gravitation,' for example, is used on occasion for the unknown cause of all those processes or properties that together constitute the facts of gravitation.

It is the aim of modern science, physical and psychological, to supply a concrete filling for such indeterminate concepts, to characterise more definitely the nature of the cause in question, and wholly to eliminate the colorless, abstract, empty and misleading notion of force or faculty. But to obtain a knowledge of causes

or, in more modest terms, to pave the way for this knowledge, we must have recourse to an exact study of the facts themselves. Modern psychology has been able to gain a deeper insight into the phenomena of attention, by subjecting them directly, in their qualitative and quantitative aspects, to careful investigation. In what follows we shall attempt, in the light of the results thus obtained, to develop a comprehensive view of the nature and functions of attention. The distinctness or indistinctness that results from attention or lack of attention we shall designate, in contradistinction to the objective and peripheral forms, as *psychophysical* or *central*. As we are here concerned with facts that are not dependent upon any particular group of conscious contents (e. g., the sensations of a single sense-department, or the ideas of perception), we may speak in quite general terms of distinct or indistinct 'consciousness' and of its degrees.

II.

The first and most important problem that arises, in a discussion of the attention or of the degrees of consciousness, is, of course, that of an exact determination of the nature of the attentive state. Wherein does this psychophysical distinctness or indistinctness consist? How are we to distinguish it from the objective and peripheral forms? Modern inquiry has proved, in the first place, that there is, as a rule, a close intrinsic connection between attention and the processes and mechanisms that subserve what we have called peripheral distinctness. If I turn my attention to some object in the room, my gaze is at once and involuntarily directed towards this object, with the appropriate degree of accommodation. But if, as I contemplate the object, my attention shifts to some topic of thought; if, as the technical phrasing runs, it changes from a 'sensory' to an 'intellectual' attention; then the muscles of accommodation involuntarily relax, and the lines of regard tend to take a parallel direction; it is as if I were looking into an infinite distance, where there are no objects to be observed. True, this connection between sensory attention and the adjustment of the sense-organ concerned—an adjustment that secures the peripheral

distinctness of the observed impression—may, within certain limits, be weakened or even abolished, though not without especial pains and practice. We are able, with a certain effort, to bring the objects seen in indirect vision to the forefront of attentive observation. One sometimes meets people in society who possess this power in a marked degree. While their eyes seem to be gazing steadily at what is in front of them, they are secretly alert to what is happening on either side. But this sort of incongruity between central and peripheral distinctness is, of course, impossible save in cases where the physiological mechanism is directly controlled by the will. Movements of the eyes are voluntary; change of accommodation is not. Hence we cannot break down the natural connection between accommodation and attention unless we direct our gaze upon an object which is not the object of attention, or attend to an object that lies outside the range of accommodation.

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There is a further difficulty. If we are to have any exact knowledge of the degrees of consciousness, we must be able to vary them at will. In other words, we must be in a position to induce, at our pleasure, this or that grade of psychophysical distinctness, as independently as may be of all extrinsic influences. Experience shows that there are but two ways, in the normal waking state, by which this end may be accomplished. We may either

distract the attention, or we may divide it. Now distraction of the attention, in the strict sense of the term, means the inducing of inattention, i. e., of the lowest degree of consciousness; so that, if we are to obtain any other grade of psychophysical distinctness, we must have recourse to a division or distribution of attention. But again, when we have reduced a given degree of concentration to a lower level, by this division of attention, we still have no standard by which we might measure the change of consciousness. For, as was said just now, the distribution of the activity of attention may be anything but uniform. As I listen to an opera, my attention is held, first and foremost, by the scenes that are enacted upon the stage and by the voices of the performers, while the music of the orchestra recedes into the background. But this attitude of mind need not persist; in scenes where the plot moves but slowly, it may be entirely reversed. In this, then, as in many other instances, there can be no question of a really uniform distribution of the energy of attention.

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phenomena of attention. When we attempt to study the changes in conscious contents that follow upon a partial withdrawal of the attention, we find that the very conditions of our inquiry are hostile to any adequate account of the altered experience. It is essential, if we are to describe what we perceive, that we hold (or are able to hold) our attention upon the objects presented. The more effective the distraction, the more imperfect is our portrayal of consciousness. Suppose, for instance, that we are asked to reproduce the contents of a page, which we have read while our thought was wandering from the subject of the book; there will be many gaps and errors in our recollection. And what holds of reading holds in like manner of quite simple tests. Suppose that we are comparing two sounds of given intensities, made by the fall of an ivory ball upon a block of hard wood,—the one heard under conditions of complete attention, the other while we are engaged upon some arithmetical problem: our judgment as to the relative intensity of the sounds is extremely uncertain. But we have no other appeal; our only means of instituting a systematic comparison, of obtaining anything better than the chance results of occasional observations, is to make our experiments and accept the report that follows. It is clear that the whole outcome is equivocal. We cannot tell how much should be ascribed to the changes in consciousness, and how much to mere inadequacy of description.

III.

All these possibilities and difficulties must be borne in mind by any one who seeks to interpret and explain the facts of the psychology of attention. The first of these facts to notice is that the *comparison and discrimination of sense-impressions* are seriously affected by division or diversion of the attention, in whatever way produced; whether the observer be called upon to work arithmetical problems, to follow a narrative as it is read aloud to him, to name or identify other sense-impressions, or what not. Not only do the judgments of comparison show large variations, indicate a wide margin of uncertainty; but the just noticeable difference, the 'differential limen,' as it is technically called, also reaches an unusu-

ally high value. The sensible discrimination, that is, the capacity to distinguish and to compare, is, again in technical expression, both 'coarser' and 'less' than is normally the case. For example, with complete concentration we are able in 70 per cent. of all tests to recognise the difference between two weights of 50 and 55 gr. laid successively upon a given area of the skin. But if the attention be distributed, by one of the above mentioned methods, we perceive the difference only in 40 per cent. of our tests.

How are we to explain this result? What are the processes that co-operate to bring it about? That the subjective difference between the weights is so much reduced by reduction of the attention can hardly be ascribed to any peripheral, physiological cause. For the stimulation is the same in both cases. We do not know that the skin possesses any mechanism of accommodation to pressure; but the only effect of such a mechanism, if it exists, would be that the weights themselves, as they were applied, should appear heavier or lighter. And this absolute shift of subjective intensity would, of course, neither increase nor diminish the difference between the two. Let us suppose, for example, that the distribution of attention co-operates with some such mechanism of accommodation to reduce by 10 gr. the value of each of the weights for sensation. We should then have to do with weights of 40 and 45 gr. The original, objective difference stands to the smaller of the weights in the ratio 1:10; this ratio has now increased to 1:8. Now Weber's Law lays it down that the sensible discrimination depends solely upon this matter of ratios; that it increases or decreases according as the quotients are larger or smaller. Consequently, the difference between 40 and 45 gr. ought to seem larger to us, and therefore be recognised in a larger percentage of tests, than the difference between 50 and 55 gr. Hence our assumption that a peripheral, physiological change co-operates with distribution of the attention to affect our sensible discrimination has led to a conclusion which is diametrically opposed to the observed facts.

We see, then, that peripheral changes cannot explain the lowering of sensible discrimination that comes with distribution of attention. And it is clear that what holds of the peripheral holds

also of the central conditions of sensation. We cannot imagine that a weakening of the excitatory processes in the cerebral cortex—such as might result from lessened excitability of a sensory center—would bring about a reduction of the apparent differences between them. Nor can we give any reason for a diminution of their objective difference, that is, for the approximation of the excitatory processes themselves. We are, therefore, forced to ascribe the observed change in sensible discrimination to the degree of consciousness, the mind's own power of apprehension. And this conclusion takes us a step farther. The effect of one and the same difference of sensory excitation, a difference mediated by just the same peripheral and central elements, will be greater or smaller according as we are more or less disposed to receive it, more or less prepared to apprehend it. This *preparedness* consists in the excitability and revivability of ideas that may be employed for the required comparision of sense-impressions. To these must be added, further, the mental activities that subserve speech,—in this case the naming of conscious contents and their differences; while, lastly, the motor innervations that precede the deliverance of a judgment of comparison may also be more or less 'prepared.' At this point, then, we may say that distribution of attention implies a lessened excitability of all the processes concerned in the apprehension and communication of the contents of perception. And it is now easy to understand why the difference must be increased if our tests are to give the same number of correct judgments as we obtained with complete concentration.

The principle which we have here laid down may be extended to all sorts of differences between sense-impressions,—qualitative, temporal, and spatial. We may, then, generalise it to read: a distribution of attention means a lowering of sensible discrimination. Our apprehension of the external world attains its greatest certainty and delicacy only by aid of an unconditioned concentration. At the same time, this law gives us our first real insight into the nature of psychophysical distinctness and indistinctness. The contents of consciousness, as revealed to us by introspection, are determined not by the excitations of sense, but by all the manifold

modifications that these excitations undergo when they cross the threshold of consciousness. There is no single sensation that has not been wrought upon in this way by a thousand busy influences. What a sensation would be without them, we cannot possibly tell; we carry with us a store of experiences and ideas, and we cannot escape from our past. Only the distribution of attention throws a certain light upon the phenomena, and shows us something of what mental processes may be that have no related states or processes to welcome them to consciousness. It seems that, in this state of attention, differences are diminished, and there is formed an obscure total impression that acts as a darkened background to raise into still higher relief the main events of consciousness.

We are now in a position to review and to estimate the *influence of attention upon sensitivity*. We mean by sensitivity the capacity to apprehend sensations in their absolute character; to experience a tone or color or smell as a peculiar content of consciousness, and to define its various attributes of quality, intensity, and duration. The first important point to notice is that we are able by attention to favor any one of these attributes at the expense of the others. If I concentrate my attention upon the pitch, i. e., upon the quality of a tone, my capacity to determine its intensity or duration is diminished. Further distribution of the attention enhances this effect. In particular, there is a tendency to underestimate the quantitative aspects of an impression,—its intensity, duration, and spatial extent,—when the degree of attention bestowed upon them is lessened. No such influence has as yet been made out in the case of quality: distribution of the attention does not raise or lower the pitch of a tone, and does not tinge a red either with yellow or with purple. But any impression, however insistent, may pass wholly unobserved, when distraction of the attention has reached a certain limit. We then have no ear for the loudest noise; and intensive smells and glaring colors are entirely unremarked.

It is but a very small proportion of these facts that can be referred to peripheral conditions. The mechanism of adaptation with which, as we have seen, certain of the sense-organs are pro-

vided, can effect but a slight decrease in the intensity of sensation. All further change must be credited to the account of attention. The fact that one attribute of sensation can reach a high degree of consciousness at the expense of others shows, perhaps more clearly than anything else, the vanity of an appeal to peripheral factors. For we find no trace in the sense-organs of a mechanism that should, for instance, diminish intensity or extent or duration for the benefit of quality.

We can, then, grant to peripheral conditions but a relatively insignificant share in these changes of sensitivity that come with a divided attention. The question now arises, whether we can point, with any degree of certainty, to the real conditions of the described phenomena. There are, we may conjecture, only two factors to be considered: preparedness for the particular sensations, and susceptibility to the ideas which the sensations are able to revive. An impression will come the more easily to consciousness, the better we are prepared for it. Where there is increased excitability of the corresponding sensory centres, it is possible for comparatively weak stimuli to set up an excitation that shall be adequate to the touch-off of a sensation. The required increase of excitability may be effected, e. g., by the state of expectation. If I am expecting a determinate sense-impression,—say, the tone of a bell or the lighting of a lamp,—I perceive it, when it appears, with especial quickness and distinctness. This preparedness for certain sensations does not imply any enhancement of their intensity: we may be prepared for weak as well as for strong impressions, and a faint sound may, on occasion, find easier ingress to consciousness than a loud sound. Hence the parallelism which, within certain limits, has been shown to obtain between increased intensity and increased concentration is not a fact of fundamental importance. It simply means that a tone, e. g., may appear louder than another tone, not only when it is objectively and peripherally the stronger, but also when we are especially well prepared to receive it.

Here again, therefore, we must lay particular stress upon the second of the two factors just now spoken of: the preparedness for all those ideas (or, more generally, for all mental acts) which

help us to assimilate, to interpret, and to define the impressions that we receive. Every new-comer to consciousness, every new conscious content, has a certain *tendency to reproduction*, that is, a certain power to call up or call back other ideas. For instance, I hear some one say "To be or . . ."; and at once there arises in me the tendency to add "not to be," and to go on with the monologue. Or I make my first visit to a picture gallery, and see a portrait, the style of which is familiar to me; I am at once reminded of the name of the painter, though he was not at all in my mind when I entered. The tendency to reproduction that a given idea possesses is dependent upon the permanence of the *association* subsisting between it and the idea which it recalls. This 'association' between two ideas is formed when they are simultaneously present in consciousness or succeed each other at not too long an interval. The more frequently the connection is realised, the more lasting will be the association of the ideas, and the stronger the tendency that each has to reproduce the other. It should be said, also, that ideas which are merely *like* one of the originals possess an equal or similar tendency to reproduce the other, despite the fact that they have never been associatively connected with it. A portrait that I now see for the first time may call up the name of a certain painter,—because its style is *like* that of the portraits with which I am familiar,—just as certainly as these portraits themselves. The effect of the association in this case is evidently indirect.

Now there can be no doubt that impressions for which we are prepared have a stronger tendency to reproduction than have sensations whose path to consciousness is not smoothed by any special susceptibility. But our 'preparation' for an impression means a special preparedness of all the ideas that are reproducible by it. The facts constrain us here, as they did just now when we sought to explain the influence of attention on sensible discrimination, to regard this factor of preparedness as extremely important. If the direction of attention can be so nicely regulated that we are able to attend to some one attribute of a sensation and neglect the rest, then assuredly we have more than can be accounted for by an enhancement of excitability in the sensory centres, and a consequent

increase of tendency to reproduction. Without some further condition, we cannot explain how it happens that the pitch of a tone may be better 'prepared for' than its intensity or duration. So far as these attributes are concerned, the excitation is just as much an indivisible unity as is the sensation or the stimulus. But every one of the three attributes has its own associative connections with other ideas. We have, then, only to imagine that the group of mental processes connected with the quality of an impression has attained a higher degree of preparedness than the group associated to intensity or duration, and we can readily understand that the former will be more clearly perceived and more easily identified than the latter. And the same explanation will hold of those typical instances of attention that we selected at the outset of our inquiry. We do not hear the noises in the street below; we do not see the pattern on the wall before our eyes. These things do not mean that the excitability of the sensory centres has fallen too low; but rather that consciousness is preoccupied, i. e., that the ideas reproducible by the impression are not in preparation.

A third fact in the sphere of sensory attention is the *analysis of complex perceptions*. So important is this analytical function, that some writers make it the fundamental fact in the psychology of attention. As instances of its working, we may cite the hearing of overtones in a clang, the tracing of simple motives in some ornate design, the tasting of a particular ingredient in a highly elaborate dish. As a rule there is little difficulty in bringing these cases under our first two heads. For it is obvious that the analyses imply the work of sensitivity and sensible discrimination. The differentiation of a content from other contents, simultaneously present, and its definition in absolute regard, without respect to these others, are the basal processes which every analysis presupposes. It follows, then, that the factors involved in attentive analysis are a preparedness for the constituents which the analysis is to discover, and a susceptibility to the reproductive influences which these constituents exert.

It is a well known fact that our analysis of a complex impression is greatly facilitated if its constituents have previously pre-

sented themselves in insolation. When the tone, which we are to hear as overtone in a given clang, is first sounded by itself upon the instrument, it stands out much more clearly in the mass of sound. When a friendly finger has traced the outline of the figure concealed in a puzzle picture, we have no difficulty in finding it again for ourselves without assistance. Our susceptibility to an impression is greater, if the impression has recently formed part of our consciousness. Now it is clear that this state of affairs is not the work of attention. The mere repetition of the stimulus sets up a tendency to its renewal, to its reception at some later time. We may have strained our attention to the utmost, and yet have been unable to hear the overtone or to see the concealed figure. Now that the stimuli have been given separately, the task offers no especial difficulty. What is it, then, that has happened in the mean time? And how do facts of this kind help us towards a knowledge of the nature of attention?

It is certain that our preliminary hearing of the overtone by itself has made us better prepared to hear it as overtone in the clang. This means that our previous preparation for the recognition of the tone in question was inadequate. Hence, the reason that the attention at first failed to perform the task of analysis set it by the clang is that its direction was too indefinite, that it could not adjust itself accurately to the required object. The attention, that is to say, cannot overcome difficulties of its own intrinsic power, but is always and everywhere dependent upon the preparedness of our ideas. If there is no preparation, then there is no analysis, no recognition, no perception. Any impression, or aspect of an impression, that can be taken in with complete attention, has been prepared for by previous experience, and serves to realise specific tendencies to reproduction. Once more, then, we are forced by facts to the conclusion that the mental state or attitude which we term attention consists in the preparedness of the ideas reproducible by the various contents of consciousness.

IV.

All the phenomena of which we have so far spoken are due to the lessening of concentration and to the repression of those changes in conscious contents which concentration effects. We have considered distribution only so far as it brings with it a lowering of concentration. At this point, however, we may raise the further question of the *influence of division or distraction of the attention upon the range or number of the objects which it embraces*. We can put the matter to test by a simple experiment. By help of an instantaneous shutter, we can project upon the screen of a camera, say, for a tenth of a second, a number of letters that do not 'make sense' or combine into a pronounceable syllable. Let us arrange them in three lines of four letters each. The observer is instructed, beforehand, to keep his gaze fixed upon the part of the screen where the letters are to be exposed. He is placed at such a distance from the camera that all twelve letters may be 'peripherally' distinct while his eyes remain unmoved. He is asked, first of all, to read as many letters as he can with undivided attention during the interval of exposure, and to report what he has seen as soon as the shutter closes. The result of the experiment is that he can name only six letters. In a second test—for which, of course, new letters must be employed—the observation is made under distraction. The observer may be required, for instance, to repeat aloud the series of whole numbers, beginning with 1, and omitting six numbers at each step, i. e., 1, 8, 15, 22, etc. When the count is in full swing, the letters are again exposed. He can name no more than three of them.

The experiments show, then, that distribution of the attention reduces the range or number of the objects that can be simultaneously grasped with complete concentration. The reduction cannot be referred to peripheral causes; for we have taken especial pains to make the peripheral conditions of the two tests the same. Moreover, the three letters that are seen in the second case are not less distinct than the former six; and it is difficult to understand how the peripheral conditions of perception should have sufficed for

these three, and not for their immediate neighbors as well. We are thrown back, therefore, upon the same factors to which we have earlier appealed for explanation of the phenomena of attention. The exposed letters find us more or less well prepared to receive them, and thus gain a more or less ready access to the consciousness of the time. Our susceptibility to impression by the visible symbols is, without any doubt, greater in the first and less in the second experiment.

Nevertheless, the question still remains why the subjective effect of a division of attention should be to reduce the number of the constituents in a total presentation, and not rather to make the presentation itself uniformly indistinct. *A priori*, the second alternative is as probable as the first. The observer, while he was engaged upon his counting, might have seen just as many letters as he saw before, without being able to identify and name a single one of them. In this case, then, our explanation seems to halt; it gives no reason for our perceiving fewer letters than we perceived with complete concentration, but perceiving these few with practically the same distinctness. In reply, it may be urged, first of all, that, as a matter of fact, our susceptibility to the different letters is not precisely the same. It has been proved, by special experiments, that some letters are read more easily than others. Moreover, we are quite safe in assuming that there are differences of preparedness or of central excitability,—accident favoring certain portions of the field of vision, or certain objects, more than others. And it is reasonable to think that such differences, once present, will lead us to see a smaller number of letters with approximately equal distinctness.

All this, however, is vague supposition. Much more important is the fact that it *is* possible, by division of the attention, to induce simply a general indistinctness of the whole presentation. In the experiment which we have just described, the observer was asked to read as many as possible of the letters during the brief interval of their exposure. That is to say, his instructions were couched in terms that of themselves laid a certain stress upon the separate constituents of the impression, i. e., upon analysis. But

we can attack the problem in a different way. We can repeat the experiment, requiring of the observer that he shall try to see as many letters as possible, and then merely give their number; he need make no effort to name them. Under these conditions, he estimates the number of the letters seen with complete attention at twelve, and can name no more than two or three. When his attention is distracted as before, by the counting, he sees ten letters in all, and cannot name a single one; the whole number appear together as an indistinct mass.

We see, then, that the simple change of instructions makes a very great difference in results. The decrease of the range of attention is now comparatively slight; but the degree of consciousness has been lowered for all objects alike. The whole visual impression has taken on the character of extreme transiency. The effect produced is much the same as that which we obtain with complete attention by shortening the time of exposure. Hence there can be no doubt that the outcome of this sort of experiment is largely dependent upon the adjustment of attention, the particular kind of preparation,—in a word, upon predisposition. Just as we may be susceptible to one and only to one of the attributes of a sensation, so may we take this or that attitude, be thus or thus prepared, as regards the number of contents that is to be expected. If we are predisposed to read individual letters, we shall do one thing; if we are merely prepared to perceive as many letters as possible, we shall do another. This difference in the adjustment of attention need not, of course, be voluntary; it may be due to causes that lie beyond our volition. But its influence can be traced more clearly and more easily in the case of voluntary attention, because here we can better take account of the constellation of ideas that has formed in consciousness.

There is still another peculiarity of the attention that we must not pass without comment. If we compare the results of the two experiments with complete concentration, we see that, in the first, more letters were read, but less of the total impression was seen, than in the second. The same conclusion follows from a comparison of the experiment with divided attention. There must, then,

be a peculiar relation obtaining between distribution and concentration. The greater the range of attention, the lower is the degree of consciousness attaching to any individual content; while, *vice versa*, the number of the objects grasped by attention decreases, as concentration upon any one of them increases. Since, now, we can measure the work of attention not only by degree of concentration, but also by the range of objects attended to, this correlation of the two—increase in the one direction meaning decrease in the other and conversely—leads us to the idea that the *energy of attention is limited and approximately constant in its limitation.*

This idea is supported and confirmed by the following fact. When we ask how the degrees of consciousness are related to one another, we find, not a uniform gradation from the highest to the lowest, but, in most cases, a fairly sharp line of distinction. Certain contents stand at the level of clear apprehension; and from them our consciousness drops away, without transition, to the level of obscure general impression, above which the other contents of the time are unable to rise. And the clearer the first group of contents, the more indistinct are all the rest. It follows, then, that an increase of concentration for certain processes implies a decrease of concentration for others. This important fact is our sole justification for opposing—natural as the opposition seems—attention to inattention, distinct to indistinct consciousness. If, therefore, at any given moment we make a cross section of the stream of consciousness, we shall find represented on it, not all conceivable degrees of consciousness, but as a rule just two groups of processes separated from each other by a considerable interval. We thus have the right to conceive of attention and inattention, and to bring our experimental methods to bear upon them, as two wholly distinct states of consciousness, rather than as degrees of the same state connected by intermediate stages. At the same time, we have a further suggestion of a certain constancy in the amount of available energy; only that we are now dealing, not simply with the energy of attention, but with the total energy of consciousness itself. For attention and inattention, extending as they do in different directions from a common point of indifference, include all con-

ceivable degrees of consciousness. Attention may rise to the level of the greatest possible distinctness, and inattention may sink into the limbo of the unconscious.

These facts, again, may be illustrated without difficulty from the occurrences of every-day life. The teacher, in his endeavor to guard his pupils from mind-wandering and distraction, seeks to bring their attention to the highest possible degree of concentration for the subject which he is discussing. He attains this end most certainly if he can connect the new matter with something already known and familiar, that is, if he can secure a maximum of preparedness for the new ideas. Again, the occupation that fills our mind most completely, i. e., that meets with an especially favorable reception from our present store of sensations, ideas and experiences, is at the same time that which makes us deaf to other claimants for the attention and inaccessible to other stimuli. The best way to overcome fatigue, pain, ill humor, distressing or irritating circumstances,—to make ourselves insensible to them,—is to apply ourselves to the task which we know by experience will lay the strongest hold upon attention. All these phenomena point to the importance of preparedness for the processes of attention, and thus serve to supplement our theoretical discussion. At the same time, they enable us to trace the constancy of the energy of attention, which (as we have maintained) finds expression in the inverse relation of concentration and distribution, to the constancy of the more extended energy of consciousness. That increase of degree is necessarily connected with decrease of range of consciousness finds its explanation in the fact that, while the degree of indistinctness remains the same, only a determinate amount of clearness in consciousness is available.

V.

Our discussion of the nature of attention has made it clear that the excitability and preparedness of ideas are the determinant factors in its operations. It is, then, to be expected that *memory and recollection, reproduction and association*, will be peculiarly dependent upon the processes to which the name of attention is given. And

as a matter of fact they are thus dependent to an extraordinary degree. The greater the concentration, the more active, first of all, is the *tendency to reproduction* of the conscious contents upon which attention is directed. The man of science who is engaged upon a definite problem, the artist who is seeking to realise a definite idea, the orator who is following out a definite train of thought, all alike are at special pains that the main issue of the task before them shall receive a full measure of attention; for in this way their whole furniture of ideas is made more available, more accessible,—the stream of consciousness runs more freely and smoothly. Only the connections that have become mechanical suffer when their terms are thrown into relief by voluntary attention. For the constructive work of creative imagination or original thought, the active co-operation of attention is absolutely necessary. It is the essential condition of all the higher forms of mental activity, theoretical and practical. It makes possible, as it continually assists, the policy of the statesman, the projects and achievements of the technician, and the combinations and inferences of the mathematician. We say that a man shows genius, when he discovers new aspects or new attributes where all the rest of the world have passed by unheeding. But such discovery demands an absolute impartiality of attentive observation, and the freedom from current views and prejudices, consecrated and confirmed by habit and tradition, which this observation implies.

Secondly, the contents that are apprehended with complete concentration, the *apperceived* contents, as they are often termed, gain a quicker and a more lasting hold upon *memory* than those which meet a divided or distracted attention; and are, therefore, when occasion arises, more easily and accurately reproduced. What is obscurely experienced ('obscurely' in the sense of psychophysical indistinctness) is but imperfectly recalled; we cannot give any confident opinion about past events unless we apperceived them at the time of their occurrence. We may "dimly remember" that something happened; but, as conscientious people, we shall "prefer to say nothing definite about it." Nor is the attention of less importance, thirdly, in the formation of *associations*. When

the contents of consciousness, simultaneous or successive, fail wholly to attract it, no amount of repetition can effect a permanent and effective association between them. It is waste of time to try to memorise rules or dates or formulæ, when one is distracted. How serious the waste is, we may infer with some approach to accuracy from an observation made in a different connection. It has been found that the time required to learn by heart a series of nonsense syllables is about ten times as long as that required to learn, equally well, the same number of short words. Now the words repeated by the inattentive student are transformed, by his inattention, into a set of meaningless syllables. Hence it will take him at least ten times as long to master his task, in this state of mind, as it would if he gave the subject his undivided attention. I say "at least" advisedly: for the inattentive student will, of course, accomplish even less than the observer who does his best to learn the nonsense syllables. Special experiments have been made to determine the influence of distraction, of a secondary occupation, upon the observation and memorising of letters, displayed one after another in quick succession; with the result that, under such conditions, the observer is wholly unable to retain or to recall the arrangement of the stimuli, their position in the series. The few letters that he has recognised, and can later reproduce, come to him as mere disconnected fragments, not as members of a circumscribed and orderly group.

The fact, then, is clear enough,—that attention is essentially concerned in retention and reproduction, in every act and function of imagination and memory. And the explanation is equally clear, when we remember that 'attention' implies the preparation of the ideas that we are seeking to reproduce, and the opening-up of their particular associative connections. 'Attentive learning' then means, simply, a learning under favorable conditions of preparedness and of tendency to reproduction. And complete distraction must mean, on its side, a reduction of both these favorable conditions to a minimum; the practical impossibility either of taking up a given idea into the memory, or of reproducing other ideas. But this conclusion seems to bring us into conflict with a point of

fact which we touched on, briefly, a short time ago: the fact that an *automatic connection of contents or movements*, a connection that has been made and established once for all, has nothing to gain from the intervention of attention,—nay, suffers a very positive loss in accuracy and rapidity of realisation, if the attention be directed upon it. Repeat to yourself a piece of poetry that you have learned by heart, and try, as you proceed, to give each separate sentence a full measure of attention: try to apperceive each successive incident of your morning's toilet, or of the formation of the letters in writing. What is the result? Your habitual associations break up and refuse their office; your hands are clumsy; you lose the thread; it is only by thinking the matter out, circumstantially, that you can continue a process which ordinarily runs smoothly and certainly to its conclusion. You made yourself master of this automatic sequence of activities, in the first place, by help of concentrated attention. Now that you have reached the goal, an apperception of the separate phases is disturbing and paralysing.

✓ A closer consideration will, however, enable us to harmonise these outstanding facts with our explanation of the phenomena of attention. For, in the first place, we have not asserted that the course of each and every organic process is favored by the attention. Nutrition and digestion, circulation and respiration, and many other related bodily activities, discharge their functions in orderly fashion for the benefit of the organism, without the least participation of consciousness and apperception. It is this same mechanical precision that we find in the activities mentioned above, which run their course most surely and certainly in the twilight of consciousness, or even in unconsciousness itself. If, then, the bringing of these processes into the full light of conscious apprehension diverts them from their accustomed path, the inference is simply that they (or, rather, their constituents) are thrown by apperception into new and disturbing relations. A single link in the chain of interconnected processes is now isolated and set in a novel context; with the result that its original effectiveness is destroyed. Diverse tendencies to reproduction are mutually exclusive. The attentive observation of one term in an automatic train

of mental or muscular activities 'prepares' a special set of ideas, very different from the terms that in the accustomed order of things would naturally follow it. It is not surprising, therefore, that the direction of an analytical attention upon these habitual sequences of mental or bodily process should mean a balk, an interruption, a loss of memory. It may be that the processes themselves are governed from subcortical brain centres, and not from those higher centres with which are connected the conscious contents experienced in the state of complete attention. If this be true, we see still more clearly why the raising of single terms of an automatic connection to the level of psychophysical distinctness must of necessity weaken or destroy the associative relations that obtain between them.

We must not close this discussion without reference to a further peculiarity of attention, the *relative slowness* with which it passes or travels from one content to another. If, for instance, we listen to a series of sounds which are a quarter of a second apart, —say, to the ticking of a watch,—we find it impossible to grasp each separate impression by a separate act of apperception. We have not time, in the brief interval that elapses after the hearing of the first stimulus, to readjust our mind for the second. The sound 'gets ahead' of us, and we soon give up our fruitless endeavor to overtake it. The consequence is that, at a certain limit of rapidity, every series of impressions breaks up, involuntarily, into groups. These groups are the foundation of all rhythmical articulation and division. We distinguish, in any given rhythm, between an accented term, and one or more unaccented terms. The accented term is apperceived; the others follow it too quickly to receive special apperceptive emphasis. It is clear, then, that the interval separating the accented terms of a rhythmical series gives us a measure of the rapidity with which successive acts of attention may be realised. With simple sound-impressions, and under favorable conditions, this interval is, approximately, one second. Similar phenomena have been observed in the process of memorising nonsense syllables by reading them aloud. At a certain rapidity of reading, the syllables fall of themselves into rhythmical

groups; and it has been proved that juxtaposed terms which belong to one and the same group, the same rhythmical 'foot' or 'measure,' are more firmly associated than juxtaposed terms which belong to different groups.

These facts, and others like them, have led psychologists to speak of a distribution of the energy of attention. Such a distribution occurs, to some extent, in the case of automatic sequences; for there are always certain terms in the series that receive a measure of apperception, however small, while the rest follow as it were in the train of the accented members. The speaker who is delivering an address that he has learned by heart gives special attention to certain cardinal points of his argument, believing that the mechanism of association of ideas will then provide for the smooth and logical development of the subordinate sentences. So that even in activities like this, where term seems to follow term altogether automatically, there is still some part to be played by the attention. But if a term that was originally unaccented, and that has its fixed subordinate place in the whole sequence, is suddenly apperceived, the train of thought will necessarily be deranged: the idea has been raised from its menial position to take all the responsibilities of a new series, to become the independent starting-point of further associations, and must, of course, break off its old connections. At the same time, the flow of the speaker's ideas will be retarded; the attention requires time to meet the demands laid upon it. Now we may freely admit that, in the complicated activities of real life, the groups are incomparably larger and the unaccented pauses indefinitely longer than they are in the simple experimental tests that we have described; but the underlying principles are in all cases the same. In real life, as in the laboratory, the accented term lays down the law for the whole series of unaccented processes that follow, in the sense that, when once the first term is given, the rest of the series runs its course with automatic precision and at unvarying speed. Each successive member of the group is determined by all the members that have gone before; and the first accented member contains within it the tendency to reproduction of all later members, i. e., of the whole group.

Now we have seen that the connection between any two groups is weaker than the connection between the members of a single group. It follows, then, that the interference of attention at unaccented parts of the series will also serve still further to weaken these wider associative connections.

We see, therefore, that the paralysis or interruption of automatic activities, by concentration of the attention upon some one or other of their phases, affords no argument against our attempted explanation of the processes of attention. On the contrary, the facts give us an interesting glimpse into the economy of mind. As an experience becomes accustomed, practised, familiar, it gradually loses in psychophysical distinctness; it approaches, and presently falls below, the limen of consciousness. Its course is then both speedier and more certain; it has grown mechanical. And while this is happening, consciousness itself can turn with increasing energy to the novel and the unaccustomed, guiding them into the right channels of reproduction, and shaping them to useful ends. Mind is thus relieved of a heavy burden: its processes, once trained to their duty, may be removed from the control of attention and left to their own devices, without fear that they will wander from the path prescribed for them. Attention is like the watchman on some high tower, who, as he surveys the country beneath him, casts an indifferent eye upon the familiar incidents and unsuspecting figures of the landscape, but keenly scrutinises any strange appearance. We have a very delicate sense for what is familiar and what is unfamiliar. Some psychologists, accordingly, believe that accustomed impressions take on a special attribute, a 'quality of familiarity,' which can make a thing appear familiar to us, without our being able to say where and when and under what circumstances it formed part of our past experience. But we may say very much the same thing of the novel and the unfamiliar: the 'quality of unfamiliarity' consisting, in part, of a certain restlessness and excitement in face of the experiences, and partly of the peculiar mood of *interest*.

Interest is a pleasurable mood, into which we lapse whenever anything 'attracts' or 'fascinates' our attention, i. e., arouses the

activity of those higher centres which form the immediate substrate of consciousness. So close is the connection between attention and interest, that the latter term is sometimes used to denote attention itself, and even to designate the objects which excite and sustain attention. When, for instance, we say that a man's interests are wide or narrow, we mean by "interests" the whole range of objects that may engage his attention. When, again, we remark that our interests lie in a certain direction, or insist that our friends ought to take an interest in certain questions, we are employing the word as an equivalent of "attention." In view of this uncertainty of usage, it is necessary for science to select and steadfastly to adhere to some one meaning: otherwise the term loses all its value. And the best meaning is, evidently, that of the mood or emotional state which invariably accompanies a strain of the attention, provided that this strain is not pushed so far as to induce fatigue and dull the faculties. The pleasurable mood of interest is very readily aroused by novel impressions, which have no fixed associations with previous experiences or stereotyped phrases. True, an increasing store of ideas, while it enables its possessor to meet and assimilate new perceptions and thoughts more quickly and easily, also sets narrower and narrower bounds to his susceptibility for the unaccustomed and the unknown. The capacity of the mind to enlarge its horizon, to multiply its aptitudes and experiences, is exceedingly limited; though we must add, in fairness, that it differs very greatly in different individuals. This is the reason that the number and variety of interesting objects are greatest in youth, and least in old age.

This decrease in susceptibility to new impressions is, in some measure, compensated by the imperfection of memory and the changes which naturally occur in our furniture of ideas. Thanks to these two influences, the familiar does not always remain familiar, but after a long interval regains something of the character and stimulus of novelty. A problem that has occupied us without interruption for a considerable period of time comes finally to be associated with a whole number of accustomed ideas, which go far to dull our interest in it and to prevent or obscure the removal of

outstanding difficulties. If we then lay it entirely aside, and return to it later from a different kind of work, we find that the very points which previously attracted but little attention strike us with all the force of a new impression and indicate, or at least pave the way for, a final solution. This is the experience of every one who has worked and thought on scientific matters. It is also the experience of the artist when he pursues an idea and attempts to give it shape; and of the inventor, when he seeks to put theory into practice. Facts of this kind are usually explained on the assumption that the earlier efforts have left their effect upon the subconsciousness and that the later advance is possible only because the mind has been silently at work. The explanation may hold in certain cases, where the interruptions of conscious occupation with a problem are but short. But we are thinking here of longer intervals,—intervals so long that the old and familiar come to us with the charm of novelty, that the mechanical and habitual connections are weakened, their certainty imperilled, and their binding force reduced. The whole problem, or whatever it may be, stands out in the clearer light of attentive consideration; it forms new connections, and enters into new associations. Furthermore, our stock of ideas has also undergone, in the meantime, more or less serious changes, so that even an old idea may re-excite the activity of reproduction, and start it developing in a new direction. This is what happens to any one who, after a lapse of years, takes up a book that he once read, or studies observantly and critically the pictures of a gallery which he once hurried through with inattentive mind.

VI.

We have no space to enumerate all the various factors that involuntarily draw our sensory or intellectual attention upon them. Nor can we pause to indicate the means which experience has shown to be best suited to induce a distraction of the attention. We must also pass over the bodily accompaniments of attention, which have recently been made the subject of repeated investigation. In the present state of our knowledge, the fact that an acceleration of pulse or irregular breathing sets in when the mind is

concentrated upon some intellectual employment, cannot be turned to account for a theory of attention. On the other hand, we cannot conclude without raising the question how it comes about that we can offer effectual resistance to distracting stimuli. Our power in this regard is of extreme importance for life in general and for mental development. If our perception and thought and volition depended solely upon the intensity of the stimuli presented to us, we should be at the mercy of external circumstances, and continuous work, any definite and systematic activity, theoretical or practical, would be utterly impossible. We should be like those unstable natures who are swayed this way and that way by every breath of opinion; there would be no such thing as acting on principle, no character that could inspire our confidence by wisdom and reliability. Is our theory of the nature of attention strong enough to bear the brunt of a fact like this, a fact of cardinal import for the whole race of man?

How well we are prepared to meet new contents that appear in consciousness depends in very large measure upon the frequency and familiarity of the ideas concerned. The more we have been obliged to occupy ourselves with certain thoughts and experiences, the more firmly do they establish themselves in our minds, and the more easily can they be reproduced and set in motion. At the same time, the simultaneous and successive connections in which the separate contents have been given become by frequent repetition stronger and more certain, and the resulting associative relations more binding and more inflexible. If, now, our susceptibility to external or internal stimuli, to peripheral and central excitations, depends upon our preparedness to receive them, then the whole of the individual's past, with all its associations, will be arrayed in order of battle to meet the scattered assaults of chance. So that, however strong a stimulation may be, still it will lack the power to break into the serried circle of ideas, or at least to hold its ground after the attempt, unless it can make clear its right to entry. What the mental acts and dispositions that we hold in preparation lack in strength is more than compensated by their connection with the permanent tendencies and capacities of the individ-

ual, and by the closeness of the associative bonds in which they are united. Behind the attention, behind distinct consciousness, stands the whole experience of a personality; and it is the nature of this experience that decides what shall excite and fascinate the attention.

Our theory has stood the test. Nay, more, it demands that apperception shall be rooted deep in the thought and volition of an experiencing subject. Circumstances do not rule us, but we confront circumstances,—choosing, arranging, and directing. Our mind is not the sport of incalculable accident; but according to the measure of the strength that is in us, the strength that manifests itself in attention, we can transcend the limits of our organism and help to mould the universe, propounding and realising ideal ends. We do not stand in the mere course of events, indifferent transmitters of mechanical processes; we prove our independence and our freedom by rational test and consideration of the impressions that pour in upon us, and by consistent devotion to the plans and tasks that our conscience has approved. But, we must remember, this power that manifests itself in attention and makes it the mirror of the whole personality is not acquired at haphazard. Education,—the education that we have received or have wrought out for ourselves, decides how well the ideas are prepared which we have to cast into the balance for attentive observation or recollection, for constructive work of imagination or understanding. If there is anything plastic in the mind and its capacities, it is surely the attention,—whose first original fickleness and uncertainty must be trained to constancy and steadiness, and whose unlimited susceptibility to all that can interest man must not be suffered to degenerate into an uncritical surrender to each and every impression, useful or harmful, seasonable or unseasonable, good or bad. We must, then, set to work betimes to ensure the right preparation for apperception. Thus equipped, we shall issue as conquerors from our battle with the changes and chances, the burdens and temptations of life.

O. KUELPE.

WÜRBURG.

THE PROBLEM OF CONSCIOUSNESS.

COMMENTS ON PROFESSOR MINOT'S DUALISM.

AT the last meeting of the American Association for the Advancement of Science, the retiring President, Prof. Charles Sedgwick Minot of Harvard University, delivered the usual presidential address before a large and select audience in Carnegie Hall, Pittsburgh, Pa., and his subject was "The Problem of Consciousness in Its Biological Aspects." The speaker was a white-bearded gentleman of dignified appearance with a somewhat dreamy eye. He had an engaging presence, and a distinct consciousness of his authority.

The speech was characterised by a vehement attack on Monism. Professor Minot said :

"Monism is not a strong system of philosophy, for it is not so much the product of deep and original thinking as the result of a contemporary tendency. It is not the inevitable end of a logical process, because it omits consciousness, but rather an incidental result of an intellectual impulse. Its very popularity betokens its lack of profundity, and its delight in simple formulæ is characteristic of that mediocrity of thought which has much more ambition than real power and accepts simplicity of formalisation as equivalent to evidence. It would seem stronger, too, if it were less defended as a faith. Strong partisans make feeble philosophers.

"Monism itself is postulated chiefly upon the two greatest discoveries of the nineteenth century—the law of the conservation of energy, and the law of the evolution of species. Both laws establish a greater unity in the phenomena of the universe than mankind had previously been able to accept. In the physical world, instead of many forces, we now recognise only one force, which assumes various forms of energy; and in the living world we recognise one life, which manifests itself in many types of forms. With these two unities in mind, what could be nearer than the thought that the unity goes still deeper, and that the phenomena

of the inanimate or physical, and of the living world are fundamentally identical ? The progress of physiological science has greatly increased the impetus towards the adoption of this thought as the cardinal dogma of the new faith, because the work of physiologists has been so devoted to the physical and chemical phenomena of life, that the conviction is widespread that all vital phenomena are capable of a physical explanation."

Now I do not know any biologist of standing who either is not a monist, or at least does not carry on his investigations with methods along monistic lines of thought. In fact, most of our naturalists and even philologists are monists; and there are almost as many kinds of monism as there are original thinkers: the philologist F. Max Müller's monism is radically different from Haeckel's, and Professor Wundt's is different from either.

In rejecting the monistic conception of consciousness, Professor Minot should at least have indicated whose monism he combated, and he would have been wise to explain and refute either Wundt or Hering or some other monist of unequivocal standing.

I would find no fault with Professor Minot for cherishing and professing dualistic views, but it seems unwarranted and improper to use for his tirades the occasion of a presidential address, which ought to be a representative condensation of the present state of his science. But the most objectionable feature of his address is its lack of positive information. And while Professor Minot is very decided in his censure, his own theories are vague and an explanation of the problem of consciousness is nowhere forthcoming. On account of its barrenness, the lecture does not deserve mention of any kind, and would have been ignored had it not been for the prominence that naturally attaches to the presidential address of a great association with scientific pretensions, the rank of the lecturer as professor in one of our most celebrated universities, and its prominent appearance in *Science* and in the *Popular Science Monthly*.

Professor Minot promised to discuss the problem of consciousness in its biological aspect, but he does not even allude to one single biological fact that would help us to understand better the functions of consciousness. Biology is only referred to in general terms and the statement is made that:

"The biologist must necessarily become more and more the supreme arbiter of all science and philosophy, for human knowledge in itself is a biological function, etc."

I should like to see Professor Minot use his biology as a criterion for the solution of an algebraic equation, or a question of historical evidence, or for the interpretation of a $\alpha\tau\alpha\acute{\eta}$ λεγόμενον in a cuneiform inscription, or apply it to the theory concerning the motions of the stars in the milky way, or to the speculations as to the origin of motion or the ultimate constitution of the chemical elements. I do not think that I have ever underrated the importance of biology, but if Professor Minot be right his colleagues had better abandon the study of chemistry, philosophy, philology, history, mathematics, etc., and apply themselves to biology, though I fear that on these lines the science of the future would become somewhat one-sided.

But let us hear what Professor Minot has to say on consciousness. He sets out with the following considerations:

"The time is not yet for giving a satisfactory definition of consciousness, and we must fain content ourselves with the decision of the metaphysician, who postulates consciousness as an ultimate datum or concept of thought, making the brief dictum *cogito, ergo sum* the pivot about which his system revolves. I have endeavored vainly to discover by reading and by questioning those philosophers and psychologists whom I know, some deeper analysis of consciousness, if possible, resolving it into something more ultimate.

"Opinions concerning consciousness are many and often so diverse as to be mutually exclusive, but they may be divided into two principal classes. The first class includes all those views which make of consciousness a real phenomenon; the second, those views which interpret it as an epiphenomenon. We are, I think practically all, agreed that the fundamental question is: Does or does not consciousness affect directly the course of events?—or, stated in other words, is consciousness a true cause? In short, we encounter at the outset the problem of free-will; of which more later."

Almost every sentence contains a wrong contrast and betrays a lack of logical clearness. It is a fair sample of the Professor's mode of thought; but we cannot lose ourselves in details, and so forego analysing it.

Monism is made responsible for the theory that consciousness is an epiphenomenon:

"The opinion that consciousness is an epiphenomenon has gained renewed prominence in recent times, for it is, so to speak, a collateral result of that great movement of European thought which has culminated in the development of the doctrine of monism."

And what is an epiphenomenon? Here is Professor Minot's explanation:

"It is essential to have a clear notion of what is meant by an epiphenomenon. Etymologically the word indicates something which is superimposed upon the actual phenomenon. It designates an accompanying incident of a process which is assumed to have no causal relation to the further development of the process. In practice it is used chiefly in regard to the relation of the mind or consciousness to the body, and is commonly employed by those philosophers who believe that consciousness has no causal relation to any subsequent physiological process."

In using the term epiphenomenon Professor Minot obviously refers to the Fechner-Weber theory of parallelism between consciousness and nervous activity, but his *résumé* is so misleading as to be almost beyond recognition. And what is his own result? First he states:

"The most striking distinction of the processes in living bodies, as compared with those in inanimate bodies, is that the living processes have an object,—they are teleological."

And he concludes:

"In order to determine the teleological value of consciousness, we must endeavor to make clear to ourselves what the essential function is which it performs. As I have found no description or statement of that function which satisfied me, I have ventured, perhaps rashly, to draw up the following new description:

"The function of consciousness is to dislocate in time the reactions from sensations."

This determination of the function of consciousness is as stilted as it is futile. It appears that Professor Minot confuses consciousness with memory and describes how former sense-impressions are awakened by similar present sensations. Here is his more explicit explanation:

"Consciousness may evoke a reaction from a remembered sensation and combine it with sensations received at other times. In other words, consciousness has a selective power, manifest both in choosing from sensations received at the same time and in combining sensations received at different times. It can make syn-

chronous impressions dyschronous in their effects, and dyschronous impressions synchronous. But this somewhat formidable sentence merely paraphrases our original description : The function of consciousness is to dislocate in time the reactions from sensations."

The process to which Professor Minot refers is not at all exclusively a function of consciousness. Every sense-impression leaves a trace of a definite form. When a new sense-impression of the same kind is made, it travels on the path prepared by the former sense-impression and reawakens its memory trace. This process is the common type of sense-activity which becomes possible on account of the retention of old traces,—a condition which is called memory. It may take place consciously or unconsciously, but there is nowhere in this process "a selecting power" of consciousness; no choosing takes place, and the dislocation in time which changes synchronous into dyschronous impressions and *vice versa* is (so far as the choosing is concerned) a mechanical combination of the same or similar features of new and old sense-impressions. Sensations travel in the paths prepared for them by analogous prior sensations, as in the type-distributing machine the several letters travel to their respective places.

It betrays a lack of the most elementary knowledge of consciousness that the description of consciousness as a dislocator is the sum-total of Professor Minot's wisdom. He harps on the same string again and again, insisting upon the importance of the idea. He declares :

"This disarrangement and constant rearrangement of the sensations, or impressions from sensations, which we gather, so that their connections in time are altered seems to me the most fundamental and essential characteristic of consciousness which we know."

He repeats himself, saying :

"The characteristic we are considering is certainly important, and so far as the available evidence goes it belongs exclusively to consciousness."

And further down he goes into details :

"Thus, for example, the child sees an object, and its reaction is to take hold of the object, which is hot and hurts the child. Later the child sees the object again and its natural reaction is to take hold of it again, but the child now reacts

differently because its consciousness utilises the earlier as well as the present sensation: the previous sensation is dislocated in time and fused with the present sensation and a new reaction follows."

That which is true in all this is trivial, but whether true or not, it sheds no light on the biological function of consciousness. At the same time Professor Minot's style is vitiated by expressions which imply that consciousness is something apart from other mental functions, for consciousness is represented as selecting, as choosing, as utilising, etc. Does Professor Minot really think that there is a consciousness in itself? It seems incredible, but it may be that when he denounces monism for denying the existence of consciousness, he means to say that the monistic view knows only mental states that are conscious, but does not recognise the independent existence of consciousness as an entity in itself. Professor Minot does not expressly state it, so I leave the question undecided.

Professor Minot further makes a few incidental remarks from which we quote the following sentences:

"The evidence is overwhelming that animals have a consciousness homologous with the human consciousness....

"Conscious actions are primary; reflex and instinctive actions secondary....

"Human evolution is the continuation of animal evolution, and in both the dominant factor has been the increase of the resources available for consciousness....

"Consciousness stands in immediate causal relations with physiological processes."

Finally Professor Minot winds up with the following consideration:

"Probably no question is so profoundly interesting to all mankind as the old question, what is the relation of the mind to the body? It is a question which has been stated in many forms and from many points of view, but the essential object of the question is always the same, to ask whether consciousness is a function of living matter, or something discrete and not physical or material."

And here is the Professor's answer:

"Consciousness has the power to change the form of energy, and is neither a form of energy nor a state of protoplasm."

This is practically all he has to say on "consciousness in its biological aspects."

Professor Minot's use of the terms "power" and "energy" is very loose and therefore the last quotation (which declares that consciousness "has power" although it is not "energy") must not be taken too seriously and certainly not literally.

Now I would like to discuss the problem of consciousness as I think it ought to be treated, but having tired my readers with an exposition of Professor Minot's views I feel that I had better limit myself to a few comments on his two bugbears—Monism and Epiphenomenon.

Monism according to Professor Minot must be a very mischievous idea and it seems a great misfortune that it has found much favor, not with the masses (for monism is by no means a popular theory), but with naturalists, the leaders in the realm of science.

Let us see what monism¹ has come to stand for.

Monism means the doctrine of unity, and there are different kinds of monism according to the standpoint chosen by different thinkers. There is a spiritual monism, there is a dynamic monism, there is a materialistic monism. Further there are combinations of the three and the agnostic monism. Büchner's monism recognises matter and force, Fechner's the parallelism of soul and body, etc. All these monisms seek the unity of the world in the assumption that there is one substance only. My own monism is different, as I seek the unity of existence not in the material of which it consists but in its mode of existence. I look upon all reality as one great system and upon all our concepts as abstract ideas, which the more general they are will prove to be more void of content. All of them have ultimately been derived from experience. Knowledge is a *description* of things or conditions; and if the description is appropriate so as to allow us to predict or even predetermine the course of events (if thought and thing tally), we call our description true. I cannot enter into further details, but the applications of this fundamental principle are manifold and important.

¹ The word was coined by Wolf, but it came into general use only in the latter half of the nineteenth century.

It implies that there are no things-in-themselves. There is no matter-in-itself, no energy-in-itself, no soul-in-itself, no consciousness-in-itself, no memory-in-itself. Consciousness (like whiteness) is a generalisation which is used to denote the characteristic quality of those various conditions that are conscious. Memory is not a faculty, but a general characteristic of mental life. It is an abstract term comprehending in one word the peculiarity due to a preservation of the traces which all physiological activities leave. Accordingly monism (as I understand it) means that all truths, if rightly understood, will form one great system of truths. There may be a contrast, but there will never be a contradiction. Dualism can have two contradictory truths. As the schoolmen said, a statement may be true in philosophy and untrue in theology, and *vice versa*. Monism does not reject the duality of contrasts, but endeavors to reconcile them in a higher unity. There can never be two contradictory truths, and whenever two truths seem to be contradictory, we have a problem.

Monism accordingly is not so much a ready doctrine as a plan of work, a method; and I need scarcely add that this method has proved very fruitful in the history of science. It has stimulated all the natural sciences, especially physiology, psychology, and also Professor Minot's science, biology, but the progress of the age seems to be barred out from his laboratory. It did not enter there and the professor has profited little by it.

In conclusion I have to add a few comments on the term *epi-phenomenon*, which has been adopted by a few modern psychologists to denote consciousness as a phenomenon superadded to physiological brain-processes. The original use of the word is limited to medical nomenclature and means simply "a secondary function"; but when the non-mechanical and non-material quality of consciousness became fully understood, some physiological psychologists introduced the term to emphasise the fact that consciousness is a function radically different from brain-activity and thus they spoke of it as superadded to cerebral motions, being a phenomenon *sui generis*, which according to conditions not yet understood appears and disappears, but is itself not a motion, not a

mechanical process, not a material substance, and in order to give it a name, they called it an epiphenomenon in contrast to the phenomena of the objective world which are modes of matter in motion.

I myself have never used the term "epiphenomenon," and am therefore free to condemn it without compromising myself. I never liked the term because it seems to indicate that consciousness is incidental and its presence or absence would be of no account. This of course is not so, although there are psychologists who have taken that stand. I believe it was Huxley who went so far as to compare consciousness to the sparks thrown out by a steam-engine which give a little light but have no power to alter the movements of the engine; may be it was some other naturalist. For our present purpose, it matters not who it was, so long as it was not a confessed monist, and Huxley is an agnostic; he takes a position which though practically opposed to dualism would neither deny nor affirm its principles or main tenets. The idea that consciousness is an indifferent phenomenon has been emphatically rejected by Hering, Wundt, Ribot, and also by myself. But while the paramount significance of consciousness must be acknowledged, the statement remains true that consciousness is not a brain-motion but a superadded phenomenon; it is an accompaniment of certain physiological processes, being the subjective phase of certain objective phenomena. If the term epiphenomenon is used in this sense, it is quite proper to speak of consciousness as an epiphenomenon. We need some term for it, and epiphenomenon (if it be only commonly accepted) will do as well as any other word. Prof. C. Lloyd Morgan, in order to distinguish consciousness from motion or kinesis, calls the realm of the subjective "metakinesis"; and Professor Minot, in declaring that "consciousness is not a form of energy," sides unknowingly with that large party of monists so vigorously condemned by him who call it an epiphenomenon, or metakinesis, i. e., a function not belonging to that set of phenomena which are modes of matter in motion.

If consciousness is not a motion, it is obvious that it cannot move. Accordingly consciousness (if it is not a form of energy)

can neither push nor pull, and this is the import of the simile in which it is compared to the sparks of the steam-engine. The simile is inappropriate, as might be expected of a simile, for says the Roman proverb *omne simile claudicat*. Even Professor Minot is sometimes extravagant in his comparisons. He says for instance:

"All science belongs in the same category as the teleological efforts of a jelly fish or a lobster. It is work done at the command of consciousness to satisfy the needs of existence."

I am far from denying what Professor Minot means, but his humility seems to me exaggerated when he classifies his professional work in the same category with "the efforts of a jelly-fish or a lobster."

If we take the simile of the spark-throwing engine *cum grano salis*, it remains perfectly true; but I should prefer to compare consciousness to the light in an engine-room which has no visible effect upon the mechanical motions either of the engine or of the muscles of the engineer; but merely reflects the picture of the surroundings upon the retina of the engineer's eye, thus enabling him to see the wheels and levers and assisting him in directing the movements of the machinery. Even this simile is inaccurate, as (in the widest sense of the term) the ether waves of light are also mechanical; but, if not wilfully misunderstood, it will help to explain the rôle of consciousness in its paramount importance and at the same time its utter want of mechanical power. Thus we recognise the truth of what Professor Minot tries to express in his paradox that consciousness "has the power to change the form of energy, but it is not a form of energy itself."

Consciousness is an abstract term, like whiteness or transparency, or any other generalisation. The quality of consciousness that is attached to a nervous state does not add an iota of mechanical power to it, but it modifies its character so as not to be an irrelevant factor in the economy of the mind. Consciousness, though not itself a motion, is the most significant feature of existence. And here is the point where I would shake hands with Professor Minot and forgive him his superficiality and lack of scientific insight. He is groping after an important truth, but he is

groping in the dark. His heart is probably on the right track, but the mechanism of his logical operations got somewhat out of gear and threw him off the track, and not knowing where to lay the blame of his confusion, he rails at the doctrine of monism which he has proved unable to comprehend.

Professor Minot thinks that monism "involves the elimination of the two concepts God and consciousness," and he adds that "monists sometimes use these words, but it is mere jugglery, for they deny the concept for which the words actually stand." May the God of monism forgive Professor Minot for his blasphemous utterances. May He who is the underlying norm of the cosmic order, the omnipresent principle of the so-called laws of nature, the eternal standard of truth, and the ultimate condition of all correct thinking,—He who is the most real reality of all actual as well as potential existence, and not mere jugglery,—may He, the God of Science, take compassion upon the confused condition of Professor Minot's brain. May he illumine his mind. May He who is One and co-eternal with the Logos forgive him his lack of logic and other failings and lead him gently on the path of science to a deeper and better comprehension of the truth. Amen.

EDITOR.

SKETCH OF THE ORIGIN AND DEVELOPMENT OF GEOMETRY PRIOR TO 1850.¹

ALL phases of culture are so interconnected that it would indeed be in vain to study any branch of history, beginning with a determinate epoch, without throwing a glance over anterior times and events.² If this historical maxim is difficult to confute with regard to any one of the sciences known to us, it seems endowed with irrefragable truth when applied to a discipline so conservative as mathematics, which does not destroy the labors of preceding periods to construct in their stead new edifices.³ Consequently before entering upon the subject proper of this history, that is, before speaking of modern geometry, we will examine briefly the origins of our science and the stages of development it passed through before reaching the state beginning with which we propose to study minutely its development.

1. To determine and historically demonstrate the first origin of geometrical research is a question which we should attempt in vain to resolve,⁴ because no written document enables us to be present at the awakening and first stammering of the human intelligence. The every-day experiences of any intelligent person lead in so natural a manner to the conception of the simplest geometrical forms, and to the consideration of their mutual relations,

¹ Translated from the Italian of Loria by Dr. George Bruce Halsted.

² Libri, *Histoire des sciences mathématiques en Italie*, 1 (Paris, 1838), p. 3.

³ Hankel, *Die Entwicklung der Mathematik in den letzten Jahrhunderten* (2. Aufl., Tübingen, 1885), p. 7.

⁴ This is treated from the psychological point of view in Book I. of the *Histoire des mathématiques* of Hoefer (2d ed., Paris, 1879), which we cite because curious, not to give assent to the ideas there maintained.

that we should seek in vain to assign the epoch of the birth of geometry, and still less are we able to cite the man to whom belongs the honor of having first cultivated this noble discipline. The information which the ancients have transmitted to us on this point is so uncertain, vague, and untrustworthy, that, if not complete darkness, certainly only glimmering light meets him who proposes to explain how and why geometry entered to make part of the field of investigation for thinkers; nay such light is so scarce that it only permits us to see the outlines of certain fragments of greater mass, which have withstood the injuries of time. What these are and what value they possess we will now briefly tell, occupying ourselves successively with the various peoples that in most remote antiquity reached a stage of civilisation sufficient to permit the study of pure science.

We shall not speak of the Etruscans, in the first place because the information relative to the geometrical thought of a people whose language is even now an enigma for philologists is, if not null, certainly very slight, and in the second place because it seems certain that they exercised influence only on the Romans, who were started and directed by them in geodetic research (see § 6). If we are equally silent about the Hindoos, it is because not being able to determine with certainty whence came the information about them which we now have at our disposal, we have no right to speak of a Hindoo geometry more ancient than and therefore independent of the Greek Geometry, with which shortly we shall be occupied. In the same way we shall deal with the Chinese; for who could ever be sure that the geometric knowledge (in any case very limited) possessed by them was not imported from abroad and then declared national property by a people whose vanity is such that even to-day it boasts of having reached in the most remote antiquity inventions at which other nations have with difficulty arrived in recent times?

The people which had its original home on the banks of the Tigris and Euphrates is held to be the first of all to cultivate Arithmetic and Astronomy. Often also, among the Assyrians and Babylonians, one can trace some knowledge of geometry, a science

toward which they felt themselves drawn by the hope of being able to apply it to foretell the future; and it is perhaps from their having labored with *geomancy* that they were led to consider, as they did, parallels, triangles, and quadrangles, to seek for methods to practically construct right angles, to divide the circumference of a circle into 6 and 360 equal parts, to determine an approximate value for the ratio of the circumference of a circle to its diameter.

2. Of far more importance for us than the people just mentioned were the inhabitants of the banks of the Nile, for the Greeks, who are without doubt to be considered our scientific progenitors, declared themselves, and were in fact, debtors to them for the foundation on which they erected their geometric edifice. Herodotus, who travelled in Egypt about 460 B. C., asserts that geometry had its origin in that country when King Sesostris divided equally among his subjects all the arable land in his realm; adding that a very powerful impulse for occupying themselves with geometry was given the Egyptians from the necessity to restore every year the boundary lines between the various properties, which lines the Nile obliterated during its periodical inundations. It is therefore not surprising to find that also Isocrates, about 393 B. C., declares the study of geometry was recommended to the Egyptian youth. In a similar manner Plato and Aristotle, Diodorus Siculus and Heron of Alexandria, Strabo and Democritus express themselves; nay, this last author, to show his own geometric ability, finds nothing better to assert than: "In the construction of lines by means of conclusions drawn from hypotheses, no one has surpassed me, not even the so-called *ἀρπεδονάπται* of the Egyptians." Who these "harpedonaptai" were is not known with absolute certainty, yet the hypothesis of M. Cantor¹ seems to us quite plausible. According to him their name (rope-stretchers) was derived from its having been their principal duty to construct in practice right angles, which they did by forming into a right triangle a rope divided into three parts respectively 3, 4, and 5 units in length.

¹ *Vorlesungen über Geschichte der Math.* (Leipsic, 1st ed., 1880, Vol. I., p. 55, 2nd ed., 1894, p. 64).

The practical origin assigned to geometry by Herodotus, the special operation assigned to the "harpedonaptai," and the existence in Egypt of huge and wonderful architectural and hydraulic works, lead us to believe that the geometry of the Egyptians had a particular tendency towards applications, and this supposition is strengthened by the examination of a very important written document which we possess, regarding the mathematics of this people. We allude to the *Manual of the Calculator* preserved for us in the now celebrated Papyrus Rhind, written by a certain Ahmes 17 or 20 centuries B. C.¹ Unfortunately this writing, while offering a large mass of matter concerning the ancient methods of calculation, gives scant information regarding the geometric knowledge possessed by the inhabitants of the land of the Pharaohs, for geometry is not treated there *ex professo*, but certain rules, given for evaluating surfaces and volumes, are tacitly applied to illustrate arithmetical procedures. In this *Manual* are found therefore only a few traces of metric geometry, upon the value of which there is not perfect agreement among the various historians.² Thus it seems indisputable that the Egyptians knew how to calculate the area of a square, but it is not certain that they knew how to do the same for a rectangle, and still more doubtful if they were able to measure with exactness the area of a triangle or a trapezoid. Again they make a circle equal to a square whose side is $8/9$ of the diameter, which is the same as assuming $\pi = (16/9)^2 = 3.1604$,—a fair approximation. As for the rules by which they measured the capacity of certain granaries, it is impossible to judge, the form of these not being told; however it helps decidedly to suppose that certain problems concerning the pyramids were solved by them by a special calculus³ presumably analogous to that which to-day we use in availing ourselves of the notions of *sine* and *tangent* of an

¹ A. Eisenlohr, *Ein mathematisches Handbuch der alten Aegypter* (Leipsic, 1st ed., 1877, 2nd ed., 1891).

² See besides the works already cited: E. and V. Revillout in *Revue Égyptologique*, 2, 1881, pp. 304-314, and Em. Weyr, *Ueber die Geometrie der alten Aegypter* (Vienna, 1884).

³ M. Cantor, "Ueber den sogenannten Seqt der alten Aegypter" (*Wiener Ber.*, 90, 1884).

angle. It is seen therefore that the geometry of the ancient Egyptians offers several obscure points, to clear up which would require recourse to other documents, but these are either still unknown or have not yet been deciphered.¹ Meanwhile, until it has been demonstrated that the Egyptians knew how to explain the geometric rules applied by Ahmes, we feel authorised to deny to the collections of geometrical facts which they possessed the character of a true science.

3. Such conclusions have importance principally because (see § 1) they exempt us from treating the question of the nature and extent of the foreign influence on Greek geometry.² In fact, admitting that the Babylonians and Egyptians had communicated to the Greeks all their geometric knowledge, these would in consequence have received from them only a very small amount, and certainly not the stimulus to mathematical research; moreover this is confirmed by the unity of direction in the evolution of all the Greek geometry, a unity which would be with difficulty explained by one considering it as a tree transplanted from a foreign land.

The person by whose initiative in Greece the torch of science is lighted and glimmers fitfully, is Thales of Miletus.³ To him we are debtors for the transportation into Europe of the germs of the exact sciences, and for the first attempts to cultivate them. If to him and to his followers (the members of the Ionic school) we cannot assign any important mathematical discovery, it is because the indisputable tendency toward physical research which Thales possessed became so pronounced in his disciples and successors (Anaximander and Anaximenes) that these came to disregard the investigations of pure mathematics. Thales and the Ionic school

¹ Cantor, *Vorlesungen*, 1 (2nd ed.), p. 23.

² As is known, the analogous question for the other disciplines and especially as to philosophy is extremely controverted: see Zeller, *Die Philosophie der Griechen* (Leipsic).

³ Further particulars concerning the geometers of whom the present paragraph treats (specially as to the relative chronological determinations) will be found in the monograph by the author: *Le scienze esatte nell' antica Grecia*, Libro I, *I geometri greci precursori di Euclide* (Mem. della R. Accademia di Modena, II., 10, 1893).

represent therefore, in our opinion, the twilight, preceding the dawn of Greek mathematics.

But the sect of Ionic physicists having disappeared, another man arises and founds another school, Pythagoras and the Italic school, in which it seems reasonable to place the fountain-head of the majestic river of geometric research. In fact, in it, with the stable systematisation attained by the theory of ratio and of proportion, the study of the problems of the "applications of areas" and the introduction of irrational quantities, were prepared the instruments which came afterwards to be continually used by the most eminent of the ancient geometers, and to which must always recur whoever intends to follow their luminous footsteps.

The destruction of the Pythagorean community did not extinguish the enthusiasm for mathematics among the admirers and followers of the philosopher of Samos; certainly we find in Hippocrates of Chios and Archytas of Tarentum, late disciples of Pythagoras, two strenuous workers in the research of geometric truth. Nor did the other philosophical sects which were afterwards so numerous in Greece remain indifferent to the progress of exact science: this is shown by what we know respecting Zeno and Democritus, Anaxagoras and Hippias, Plato and Aristotle, and the phalanx of thinkers who were instructed or directed by these.

Thanks to the co-operation of so many great geniuses, there was laid so solid a foundation for the geometric edifice, that more than one judged that the time had come to organise into a body of doctrine the results of the investigations accomplished. Besides were studied thoroughly the three famous problems, the quadrature of the circle, the duplication of the cube, and the trisection of the angle, which gave opportunity (to Archytas, Eudoxus of Cnidos, and Deinostratus), for inventing important new lines plane and of double curvature. Moreover there were discovered and co-ordinated by Aristæus the Elder, the properties and various applications made of those curves which Menæchmus discovered and Kepler was later to recognise as the trajectories of the planets; finally the conception of infinity makes timidly its ingress into mathematics, where it was destined to occupy later a position of

exceptional importance. At the same time also the methods of research and exposition of geometric truth were made objects of accurate study;—we arrive thus at the *method of reduction* due to Hippocrates, the *analytical method* formulated by Plato, the *method of exhaustions* so brilliantly applied by Eudoxus. On the other hand by introducing the diorism Leon points out an important complement required in the solution of any problem; while by determining the conditions of invertibility of a theorem, Menæchmus teaches a fruitful method for deducing from one proposition, others. Moreover, logic which is joined to mathematics by so many intimate bonds, received powerful impulses from dialectics, from the sophists, and from the teaching of Socrates; it was in consequence so conspicuously perfected, that Aristotle thought the moment had come to expound its fundamental canons in a work which afterwards remained a classic for long ages.

4. From this appears how everything seemed to conspire to the emergence of a period of singular bloom for geometry, and in fact this did not delay its coming; this falls within the Græco-Alexandrine epoch and, compared with the periods preceding and following, merits the name of *golden period of Greek geometry*, by which we choose to designate it. To make a completely faithful picture of it is to-day an impossible undertaking,¹ since only a few persons of that epoch can be portrayed with exactness; of others we perceive only a few outlines, of still others we know the existence, but are not able to descry the lineaments and contour. However, what we know enables us to assert that, just as Greek philosophy in the period of its most dazzling splendor found in Socrates, Plato and Aristotle its most conspicuous representatives, so in the golden period of Greek geometry tower gigantic Euclid, Archimedes, and Apollonius. Through the merit of the first of these geometers the civilised world came into possession of a wisely arranged collection of the most essential properties of figurate space, a collection which throughout centuries and centuries was consid-

¹ See G. Loria, *Le scienze esatte nell' antica Grecia*, Libro II, *Il periodo aureo della geometria greca*. (*Mem. della R. Accad. di Modena*, II, 11, 1895).

ered a code of insuperable value and which always inspires admiration and respect even in those who do not blindly accept its arrangement and precepts. The second—Archimedes—founder of the family of Italian geometers, organiser of the higher metrical geometry, precursor of Leibnitz and Newton—reveals himself to us as of such marvellous fecundity in devising expedients to solve, entirely without the aid of the concept of infinity, a number of questions which to-day are regarded as strictly pertaining to the infinitesimal calculus, that the study of these still fills us to-day with astonishment and makes us sadly ask ourselves whether the invention of general methods which has so much exercised modern scientists has not perhaps dried up the source of ingenious expedients. Less vivid and spontaneous does the admiration arise in one who contemplates the works of Apollonius, because we are so identified with the present methods of research, quick and general, that with difficulty can we appreciate how great a mass of work was required in reaching the truth without invoking their aid; thus we can hardly defend ourselves from a sense of surprise which retards the enthusiasm; but when we attain this we come to justify those who consider Apollonius the greatest geometrical genius that the world had seen before Steiner.

The united efforts of these three great mathematicians, of their contemporaries or immediate successors, (among whom we name Hypsicles of Alexandria, Diocles, Nicomedes, Perseus, and Zenodorus), established an impregnable foundation for the whole geometric edifice, prepared the ground for the infinitesimal calculus and increased immeasurably the sphere of influence of geometry by bringing within its confines new and most interesting geometric forms. These led to numerous solutions of the problems (already famous in the pre-Euclidean period) of the duplication of the cube and the trisection of the angle, and taught geometers to consider that of the quadrature of the circle from the only point of view which—with the algebraic knowledge of the epoch—then permitted a solution. Moreover these laid the foundation of the geometric study of maxima and minima, and particularly of the doctrine of isoperimetry. Lastly by furnishing the most important elements

of that celebrated didactic aggregate which goes by the name of *locus resolutus*, they employed themselves in paving the way for future investigators, striving thus that the spirit of geometric research should not die with them.

5. The list of great names which Greek mathematics vaunts would present an unpardonable gap if it did not mention Heron of Alexandria and Claudius Ptolemy.¹ The scientific work of the former was specially geodetic and that of the second, astronomic; this makes Heron appear as the most ancient Greek writer on geodesy, and establishes his close connection with Ahmes (see § 1), but his work can be estimated with slight exactness and great difficulty on account of the present condition of the manuscripts, which are blemished by omissions and corrupted by additions of doubtful value made by anonymous commentators;² on the contrary the achievements of Ptolemy can be judged because his most important work—the *Mathematical Composition (Syntaxis Mathematica)* or *Almagest*—has reached us (by way of the Arabs) complete, and presents to us a treatise of spherical trigonometry accompanied by important chapters on plane trigonometry and founded in part on the theory of transversals for plane and spherical triangles, of which the geometer Menelaus of Alexandria had previously laid the foundations.

After the great thinkers mentioned in this and the preceding paragraph, for many intrinsic and extrinsic reasons, which this is not the place to discuss, the love for geometric research seems to grow cold among the Greeks, or at least the power to accomplish it disappears; then begins the epoch of the commentators, which we choose to call by the name of *silver period of Grecian geometry*.³

¹ Cf. G. Loria, *Le scienze esatte nell' antica Grecia*, Libro III., *Il substrato matematico della filosofia naturale dei Greci* (Mem. dell' Accademia di Modena, 1900).

² The recent discoveries of the *Menepiva* made in a manuscript now at Constantinople and the complete edition of the works of Heron which is now being prepared lead us to hope that soon upon this scientist also we shall be able to pronounce a definite judgment.

³ Cf. G. Loria, *Le scienze esatte nell' antica Grecia*, Libro IV., *Il periodo argenteo della geometria greca* (Mem. dell' Accademia di Modena, 1900).

To this appertain Eutocius and Proclus, whom we gratefully remember on account of the numerous and important points of information which they preserved for us concerning the ancient geometry and the ancient geometers, but who did not carry our science a single step forward; rather we might say that Proclus tried to make it retrograde, when in commenting on Euclid he mixed mathematics and philosophy, as if he wished to replace in honor a system which precisely Euclid, perhaps the first, had with full reason vigorously combated by his example. Neither does Serenus of Antissa or Antinoupolis¹ merit much greater honor, who dealing with the sections of the cylinder incidentally demonstrated that the harmonic relation is projective, nor Theon of Alexandria who edited Euclid and illustrated Ptolemy. But let us bow reverentially to Pappus of Alexandria who brought notable contributions to the works on which he commented in his celebrated *Mathematical Collections*; in it noteworthy additions to elementary geometry are made, new properties of the spiral of Archimedes are pointed out, two new constructions for the Quadratrix of Deinostratus which are extremely noteworthy as being founded on stereometric considerations are demonstrated, and the spherical curve analogous to the spiral of Archimedes is defined and studied, which gave Pappus the occasion for finding the area of a certain portion of the sphere, thus making the first known complanation of an area not plane.

We pass over the additions made to the theory of isoperimeters to record the theorem unjustly attributed to Guldinus (1577-1643) establishing a close relation between the position of the baricenter of a plane figure and the volume which this generates by rotation about an axis; furthermore the numerous relations of segments which are to-day considered as indispensable parts of the theory of harmonic relation and of involution. Does not this suffice to show that the Greek mathematical genius, like a failing lamp, emits, while dying, a beam of resplendent light?

6. On the mathematical stage as prime actor the Roman peo-

¹ See Heiberg, "Ueber den Geburtsort des Serenos" (*Bibl. math.*, 1894).

ple follows the Greek, but its appearance marks an indisputable retrogression.¹ For the Romans, conquerors and legislators of the whole world, seem to have been without any tendency toward research in pure science.² Their mathematics, even at the moment in which it most shone, was essentially practical; we could even say that it was only religious and legal.³ If geometry did not during the Roman epoch fall into complete oblivion, the merit is due to the surveyors, who, however, had no other intention than to reach in their operations an accuracy sufficient for the every-day needs of civil life, and in particular to execute the order of Augustus, who wished to have carried out the ancient project of Julius Cæsar to measure the area of the empire.⁴

The Middle Ages do not afford material for long consideration. The utter darkness which during this period wrapped up all mankind is not pierced by any sprinkling of light derived from any scientist worthy of the name; to prove how low was then the level of mathematical knowledge, it is sufficient to remark that among all

¹ To confirm this assertion, we cite the following eloquent words of the celebrated historian of Italian mathematics: "....mais bientôt le Romain arrive, il saisit la science personifiée dans Archimède, et l'étouffe. Partout où il domine, la science disparaît: l'Étrurie, l'Espagne, Carthage en font foi. Si plus tard Rome n'ayant plus d'ennemi à combattre, se laisse envahir par les sciences de la Grèce, se sont des livres seulement qu'elle recevra: elle les lira et les traduira sans y ajouter une seule découverte. Guerriers, poètes, historiens, elle les a eus, oui; mais quelle observation astronomique, quel théorème de géométrie, devons-nous aux Romains?" *Libri, op. cit.*, I., p. 186.

² Cicero himself recognised this, saying: "In summo honore apud Græco-geometria fuit; itaque nihil mathematicis illustrius; at nos ratiocinandi metiens digne utilitate huius artis terminavimus modum." *Tusc.* I., c. II., 5.

³ To show how the Romans misunderstood the true character of mathematics, suffice it to say that they confounded it with astrology and the sister arts; no wonder then that in the code of Justinian certain laws are collected under the title: *De maleficiis et mathematicis et ceteris similibus*, and among them the following: "ars autem mathematica damnabilis interdicta est omnino." See M. Cantor, *Mathematische Beiträge zum Kulturleben der Völker* (Halle, 1863), p. 397; Hankel, *Zur Geschichte der Mathematik im Alterthum und Mittelalter* (Leipzig, 1874), p. 301. It is well to observe also that if during the imperial period we meet some mathematical investigation, its author is some Greek.

⁴ It is expressly to the practical part of geometry that the Roman legislator alludes when in the above-mentioned Code he wrote: "Artem geometriae discere atque exercere publice interest." (See Hankel, *I. c.*)

the students of that epoch, Gerbert (d. 1003)—later Pope Sylvester II.—appears a giant, and yet we try in vain to cite some discovery of his in the field of exact science. However, we may note that the numerous sacred monuments erected during the Middle Ages—which according to the genial conjecture of a great poet are so numerous and bold because they represent the only method of expression then conceded to the human intellect¹—prove that such part of the theoretic science as every architect must have at his disposal was even in those times generally known. But a word of grateful praise must be spoken in favor of the Arabs, who performed the modest, but useful and certainly not ignoble, part of transmitters into Europe of the Hellenic science, nor did they fail to bring to our mathematical knowledge (especially in the arithmetical field) additions and modifications worthy of being honorably mentioned in the annals of our science.²

7. This period, so sad for the mathematic discipline, can be said to end about 1200 with the appearance of Leonardo Fibonacci of Pisa (1180–1250 *circa*), able calculator, fine geometer, and genial algebraist; for only when algebra, transported into Europe by this eminent scientist, and his meritorious works had exercised their influence—and to perceive it manifest we must go down to the appearance in 1494 of the *Summa* of brother Luca Paciuolo (about 1445–1514)—commenced a time of extraordinary activity, which Italians mention with legitimate pride, because then that country swayed worthily the mathematical sceptre. But we observe that this period, if it had great importance for analytical research, did not assist in any sensible progress of our geometrical thought. In truth Tartaglia (1500–1557) and Cardan (1501–1576), Scipio Ferro (?–1526) and Lodovico Ferrari (1522–1565), and the other minor geometers of that time have the glory to have contributed effec-

¹ See the admirable chapter entitled "Ceci tuera cela" of *Notre Dame de Paris*, where Victor Hugo writes among other things: "Il existe à cette époque, pour la pensée écrite en pierre, un privilège tout à fait comparable à notre liberté actuelle de la presse. C'est la liberté de l'architecture."

² See Suter, "Die Araber als Vermittler der Wissenschaften in deren Uebergang vom Orient in den Occident." (*XXV. Jahressheft des Vereins schweiz. Gymnasiallehrer*, 1895.)

tively to the foundation and development of the theory of equations, not disdaining to propose and accept the public challenges, which were a noteworthy characteristic of this epoch; but, on the other hand, they transmitted to posterity geometry very nearly as they received it from the Greeks by way of the Arabs. Only we observe that, among the questions dealt with in that epoch by the Italian scientists, some refer to the geometrical constructions to be executed with a single opening of the compasses. This is a conception which is unjustly considered by Montucla as *une bagatelle géométrique*,¹ which is found in Number V. of the challenge problems sent in the celebrated contest between Tartaglia and Ferrari in October, 1547,² and which G. B. Benedetti (d. 1590) has unfolded in his work *De resolutione omnium Euclidis problematum aliorumque una tantummodo circuli data apertura* (Venice, 1553) and which gave rise later to *La geometria del compasso* (Pavia, 1797) by Lorenzo Mascheroni (1750-1800)—in which is demonstrated the possibility of solving without a straight edge all the problems of elementary geometry—and, after having been modified, to *Die geometrischen Constructionen ausgeführt mittelst der geraden Linie und eines festen Kreises* (Berlin, 1833) by Jacob Steiner (1797-1863)—a work in which is indisputably demonstrated a fact (that indicated by the title) which, as this great geometer recognises and indicates, had already been pointed out.³

8. After the time of the able scientists to whose labors we owe the solution of the equations of the third and fourth degree, the primacy in mathematics was attained by France, especially through the merits of Viète (1540-1603), whose labors for algebra it is not necessary to record here, and whose interest for geometry is shown

¹ *Histoire des mathématiques*. T. I. (2d ed. Paris An. VII.), p. 570.

² For greater particulars see Kutta, "Zur Geschichte der Geometrie mit konstanter Zirkelöffnung" (*Nov. Acta Abh. der k. Leop. Carol. Akad.*, 71, 1897). It is sufficient to note that Ferrari himself makes the consideration of such problems go back to a period much anterior; in fact, he speaks of "that fine invention, to operate without changing the opening of the compasses, of which I do not know the origin, but which I know well that many fine geniuses have in the last fifty years worked hard to add to."

³ Poncelet, *Traité des propriétés projectives des figures* (Paris, 1822) §§ 351-357.

by the construction which he gave for a circle tangent to three others, expounded by him in the form of a restoration, in the work entitled *Apollonius Gallus seu exsuscitata Apollonii Pergaei περὶ ἑπαθῶν* *geometria* (Paris, 1600). Not long afterwards Mydorge (1585-1647), Pascal (1623-1662),¹ and Desargues (1596-1662)² strengthened the supremacy of France by adding to the patrimony of geometry original views, new methods, and new propositions; in fact in *Claudii Mydorgi Conicorum operis* etc. (Paris, 1631-1639) is found, not to mention other things, for the first time the homothetic transformation of one conic into another: from the *Traité général de la Roulette* of Pascal we learn a number of admirable properties of the cycloid, while the applicability of the method of perspective to the study of the conic sections and the celebrated theorem which bears the name of Pascal (although the author had preferred to designate it by that of the "mystic hexagram") are found in the celebrated *Essai pour les coniques*; finally in the *Œuvres de Desargues* (ed. Poudra, Paris, 1864) are found for the first time treated together the three conic sections, the concept of the involution of points is introduced, and its presence demonstrated in the section of a plane quadrilateral with a right line ("transversal"), and not only is perspective applied, but also with great breadth and ability the idea of infinity³ as a potent auxiliary for the research of the plastic properties of space.⁴

That also in England and Germany geometry had not fallen during this epoch into a complete oblivion is shown by the lectures given at Oxford by Henry Savile (1549-1622), who founded there two chairs of mathematics still in existence, and by the geometric

¹ See J. Bertrand, *Blaise Pascal*, (Paris, 1891).

² S. Chrzaszewski, "Desargues's Verdienste um die Begründung der projectivischen Geometrie" (*Archiv*, II., 16, 1898).

³ Newton inspired by Desargues wrote: "Lineae parallelae sunt quae ad punctum infinite distans tendunt." *Principia*, Book I., Lemma 22.

⁴ To Desargues Poncelet attributes the geometrical method which consists in substituting for a curve a system of straight lines (*Propr. proj.*, 2nd ed., Vol. II., Paris, 1866, p. 128); but that this attribution, although accepted by many, lacks a solid foundation, I have proved in the note entitled "Desargues e la geometria numerativa" inserted in the *Bibl. math.*, 1895.

researches of John Kepler (1571-1630) to whom we can attribute¹ the concept of the point at infinity of the straight.

9. The greater part of the geometric ideas given and applied by the geometers just cited remained for long years fruitless. They were as if suffocated in the heavy analytical atmosphere which we have already indicated. Yet in the seventeenth century the supremacy of analysis is not yet so manifest as to make geometers forget the problems whose solution they had so long and so earnestly desired; whence it is that then among the tendencies of the epoch and the aspirations of the scientists there arose a contest *sui generis*, by the clash of contradictory opinions was generated a spark, mother of a conflagration destined to illuminate the entire universe² and

"Di cui la fama ancor nel mondo dura
E durerà quanto il moto lontana :"

—analytical geometry is born.

Although already in some practical proceedings employed by artists and astronomers of Egypt and later by the Roman surveyors, as well as in some methods which were applied by Greek geometers of the first order, such as Heron and especially Apollonius,³

¹ See C. Taylor, *Ancient and Modern Geometry of Conics* (Cambridge, 1881), pp. lvii-lix.

² See E. du Bois-Reymond, "Culturgeschichte und Naturwissenschaft" in the collection *Rede*, I., 1886, pp. 207-208.

Concerning the prehistory of analytical geometry see Günther, "Die Anfänge und die Entwickelungsstudien des Coordinatenprincips" (*Abhandl. der Nat. Ges. zu Nürnberg*, 6; compare *Bull. Bonc.*, 10); the conclusions of this work were confuted by Zeuthen in the "Note sur l'usage des coordonnées dans l'antiquité et sur l'invention de cet instrument" (*Bull. de l'Acad. danoise des Sciences*, 1888), to which Günther replied in the *Neue philosophische Rundschau*, 1888.

³ In truth, whoever studies thoroughly the treatise of Apollonius on *Conics* must confess the profound analogy it bears to an exposition of the properties of the curves of the second degree by means of Cartesian co-ordinates; not only do the fundamental properties employed by the Greek geometer to distinguish the three curves one from the other translate into the canonical equations of the same in Descartes's method, but many of the reasonings given, when translated into the ordinary language of algebra, answer to elimination, solution of equations, transformation of co-ordinates, and the like. What we would however seek in vain in the Greek geometer is the concept of a system of axes, given *a priori*, independent of the figure to be studied.

it is easy to see some trace of what to-day we call the system of orthogonal Cartesian co-ordinates; although already the Arabs and the Italian algebraists of the Renaissance had adopted geometric considerations to solve graphically certain equations; although Vieta had already used abscissas for particularising with the help of numbers the points of a straight, and Nicole Oresme (about 1320-1382) had made use more or less explicitly of co-ordinates it seems now settled beyond dispute that Descartes (1596-1650)¹ and Fermat (1608-1665)² were the first to see in its whole extent the possibility of representing by means of the symbols of algebra the forms of space constructed according to any law, and to perceive all the advantage which analysis and geometry could derive from their unexpected marriage.³ Fermat perhaps came before Descartes to the new branch of mathematics, but what he published is of later date than the celebrated *Geometrie* (1637). In this work is given explicit indication of the equation of the curve, and a solution of the problem *ad tres aut quatuor lineas*, so famous among the ancients; moreover the distinction between algebraic and transcendental curves is suggested, and a classification, now abandoned, of the algebraic curves is proposed, by adopting which the curves of the degrees $2n-1$ and $2n$ would be classed in the same *genus*; a method is taught of drawing tangents to plane curves, which later is applied to the conchoid and to the ovals of Descartes; nor is the possibility overlooked of extending to space the method of co-ordinates. On the other hand, in the memoir by

¹ See Jacobi, "Ueber Descartes's Leben und seine Methode, die Vernunft richtig zu leiten und die Wahrheit in den Wissenschaften zu suchen" (*Ges. Werke*, 7, 1891; see also *Journ. de Math.*, 12, 1847), Arago, *Oeuvres Complètes*, 3, Paris, 1855.

² Arago, *loc. cit.* See *Oeuvres de Fermat* (ed. P. Tannery and C. Henry), 1, (Paris, 1891), 2 (1894) and 3 (1896).

³ That the *Analysis geometrica, sive nova et vera methodus resolvendi tam problemata geometrica quam arithmeticam quaestiones*, by Hugo de Omerique (1634-?), the first part of which appeared at Cadiz in 1698, suffices to make its author seem the precursor of modern analytical geometry (as is affirmed by P. A. Berenguer in the article entitled "Un géometra español del siglo XVII.," inserted in *Progrés*, 5, 1895), is a yet unsolved question, because for this purpose it would be necessary to know the second part of that work, which has not yet come to light.

Fermat *Ad locos planos et solidos isagoge* (in *Varia Opera*, 1679) the conception of the equation of a curve is more clearly set forth than in the *Géométrie*; besides, the equation of the straight is employed, the general equation of the second degree with two indeterminates is discussed, and the method of co-ordinates is applied to the solution of equations. If we add that Fermat discovered and corrected some errors of Descartes, it will be seen that it is rather by a lucky chance than on account of true merit that the discovery of analytical geometry is regarded as inseparably connected with the name of the author of the *Discours de la méthode*, instead of with that of Fermat.

The facility with which the new mathematical instrument solved problems which had surpassed the powers of the ancients, caused the majority of Descartes's and Fermat's contemporaries and immediate successors to abandon the path opened up by Euclid and by Apollonius; they preferred to enter upon the new road which, on the one hand, appeared smooth and easy to travel,¹ and, on the other hand, attracted them on account of the obstacles with which it was always bestrewn, and which seemed very important to remove. Among these early cultivators of analytical geometry are conspicuous J. Wallis (1616-1703) for his *Tractatus de sectionibus conicis nova methodo exposita* (1655), Florimond de Beaune (1601-1652), and Franz van Schooten (?-1661) thanks to their commentaries on Descartes, and still more Johann De Witt (1625-1672) for his *Elementa curvarum linearum* (1658).

10. The modes of procedure of mathematical investigation founded on the methodical use of the infinite and the infinitesimal, applied by Archimedes in antiquity in a peculiar manner and prepared many centuries later by Kepler's *Stereometria doliorum* (1615) and the *Geometria indivisibilibus, etc.* (1635) of Bonaventura Cavalieri

¹ "Ainsi, à certaines époques, où, après de grands efforts, les sciences mathématiques semblent avoir épuisé toutes les ressources de l'esprit humain et atteindre le terme marqué à leurs progrès, tout à coup une nouvelle méthode de calcul vient s'introduire dans ces sciences et leur donner une face nouvelle. Bientôt on les voit s'enrichir rapidement par la solution d'un grand nombre de problèmes importants dont les géomètres n'avaient osé s'occuper, rebutés par la difficulté." Condorcet in his *Eloge de M. Euler*.

eri (1598-1647), by the methods of constructing tangents to curves imagined by Descartes and by those which Fermat suggested for the research of maxima and minima,¹ finally by the investigations of Roberval (1602-1675)², of Torricelli (1608-1647), *Opera geometrica*, 1664³ of Gregory St. Vincent (1584-1667) (*Opus geometricum*, 1647), of Wallis (*Arithmetica infinitorum*, 1655), of Pascal, etc., and invented, soon after the appearance of the *Géométrie* of Descartes, at the same time by Leibniz (1646-1716)⁴ and Newton (1642-1727),⁵ emphasised the tendency characterised in the preceding section, causing all those problems to be neglected whose solution was not adapted to exhibit the omnipotence of the methods which the world owes those immortal minds. So much so that we may say that, excepting Newton's *Philosophiae naturalis principia mathematica* (1686) and some hints of Leibniz⁶ of a "Characteristica geometrica," a few pages of Huygens (1629-1695)⁷ and of Maclaurin (1698-1746)⁸ as also, finally, some memoirs by Stewart (1717-1785)⁹ and

¹ See Zeuthen's interesting note "Sur les quadratures avant le calcul intégral et en particulier sur celles de Fermat" (*Bulletin de l'Acad. danoise des Sciences*, 1895).

² *Mem. de l'Acad. des Sciences*, 6, Paris, 1630.

It is important to bear in mind that some inaccuracies in the *Observations sur la composition des mouvements, et sur les moyens de trouver les touchantes des lignes courbes* by Roberval were rectified by Duhamel (1797-1872) in the "Note sur la méthode des tangentes de Roberval" (*Mem. des Sav. Étr.*, 5, Paris, 1838).

³ See also: G. Loria, "Evangelista Torricelli e la prima rettificazione di una curva" (*Lincei Rend.*, V., 6, 1897, ii.), and "Le ricerche inedite di Evangelista Torricelli sopra la curva logaritmica" (*Bibliotheca mathematica*, III., 1, 1900).

⁴ See Fontenelle, *Éloges des académiciens* (La Haye, 1740), 1; Harnack, *Leibniz' Bedeutung in der Mathematik* (Dresden, 1887).

⁵ See Fontenelle, *op. cit.*, 2; Arago, *Œuvres complètes*, 3 (Paris, 1855); Brewster, *The Life of Sir I. Newton* (London, 1831), and *Memoirs of the Life, Writings and Discoveries of Sir I. Newton* (Edinburgh, 1855).

⁶ *Mathematische Schriften* (ed. Gerhardt), 5, pp. 141-171.

⁷ See in particular *Horologium oscillatorium* (Paris, 1673), and *Traité de la lumière* (Leyden, 1691); moreover his scientific correspondence published in *Œuvres complètes de Chr. Huygens* (La Haye, 1888 and follow.).

⁸ *A Complete System of Fluxions* (Edinburgh, 1742).

⁹ *General Theorems of Considerable Use in the Higher Parts of Mathematics* (Edinburgh, 1746); see its analysis by Breton (de Champ) in the *Journal de*

by de la Hire (1640-1718)¹ and a few efforts to revive the ancient geometry,—efforts to which we shall immediately devote a few lines,—no eminent mathematical production of the epoch of which we speak belongs to pure synthetic geometry.

The attempts to which we have just now alluded are found, we may say, in every century, beginning from the Renaissance, and appear either in the form of editions of the ancient geometers and commentaries upon them, or in that of restorations of works which were not saved from the ravages of time. It is not here in place to speak of the editions and commentaries, but we must devote some lines² to the reconstructions, in the first place because their significance is indisputable when they bear the names of Maurolycus (1494-1575), Vieta, Fermat, Schooten, Viviani (1622-1703), Halley (1656-1742), Simson (1687-1768),³ Horsely (1733-1807), and in the second place because their appearance is the first indication of an awakening of the spirit of geometrical research. And in truth this is a phenomenon which seems to us worthy of the most serious consideration that in such a state of somnolence as preceded the awakening, scientists did not succeed in resisting the fascination exercised by the most ancient investigators, and, in consequence, attempted to tread in their foot-steps and even to imitate their movements and their gestures. We should therefore be led to conjecture

Math., 13, 1848, as well as a valuable article on the latter by T. S. Davies, in the *Trans. of Edinburgh*, 15, 1844; *Propositiones geometricae more veterum demonstratae* (Edinburgh, 1763).

¹ See—besides Fontenelle, *op. cit.*, 2—E. Lehmann, *De la Hire und seine sectiones conicae*, I. Th., Leipzig, 1888; II. Th., Leipzig, 1890. Of De la Hire we mention here the following writings: *Sectiones conicae in novem libros distributae*, 1685; *Mémoirs sur les épicycloïdes*, in *Anc. Mém. de Paris*, 9; "Traité des roulettes" in *Nouv. Mémoirs de Paris*, 1706; *Des conchoïdes générales*, Id., 1709.

² More particulars will be found in the appendices to the first two books of my work, cited above, on *Le scienze esatte nell' antica Grecia*.

³ Concerning the efforts made by Simson and Stewart to give new life to ancient geometry, see Buckle's remarks in *History of Civilisation in England*, 4. Let us add that the fight in England between analysts and synthetists prolonged itself even into our century; this is proved by the two rival works: *Geometrical Analysis and Geometry of Curve Lines*, by J. Leslie (Edinburgh, 1821), and *A Treatise on Algebraic Geometry*, by D. Lardner (London, 1831).

that in the intellectual life of nations there happens something analogous to what embryology shows to take place in the physical life of every living being ; in the same way that every organised being, before acquiring an autonomous and independent life, passes through all the phases of development that the species to which it belongs traversed before reaching the physical state of the generation to which it shall belong, so it would appear that every people before acquiring the capacity of increasing our knowledge concerning the phenomena which are presented by figured extention, must for some time assume the appearance and the ways of acting of those who before them went over the same road. This law of development being accepted as true, we avoid including among the rubbish that which instead is a germ, and we can render an account of certain facts which otherwise would be considered surprising anachronisms. And among these none seems more worthy of mention than that presented by the "Neapolitan School" so much extolled by Chasles,¹ which had as supreme leader Nicola Fergola (1753-1822) and as secondary heads or privates Annibale Giordano (1771 *circa* 1835), Vincenzo Flauti (1782-1863), Felice Giannattasio (1759-1849), Giuseppe Scorza (1781-1843), and others whose names are omitted for brevity,² a school which would be placed among those which had very little influence on geometry if it should not instead, according to our view, be retained to represent a stage which the mathematics of the noon-tide of Italy had necessarily to go through before being ready to combat for the conquest of new truths.

11. But it is necessary that we turn back to determine what may have been the influence on the development of geometry of the fundamental concept of infinitesimal analysis, which is considered by a great philosopher and mathematician as the most sublime thought to which the human mind has attained up to the present time.³ We cannot deny that its appearance had drawn away the

¹ *Aperçu historique*, 2nd ed. (Paris, 1875), p. 46

² For further notice refer to my work entitled *Nicola Fergola e la scuola dei matematici che lo ebbe a duce* (Genoa, 1892).

³ Comte, *Cours de philosophie positive*, 1 (Paris, 1864), p. 175.

majority of mathematicians from pure geometry;¹ nevertheless the period which comes after this must without hesitation be counted among the happiest for geometry, since the greater part of the problems proposed or solved by Newton and Leibniz and by their immediate disciples must be placed among the most important embraced by geometry, relating to the most recondite and interesting geometrical or mechanical properties of curves and surfaces. As a consequence we see extraordinarily augmented not only the number of curves made the objects of study,² but (what is more important) we see introduced the consideration of the singularities of a curve and of new elements connected with this, and we see revealed in consequence fields of research of which no one before had imagined the existence.

The facilities afforded by the Cartesian method for investigations concerning the geometry of the plane, which were at their height when the infinitesimal method came into the possession of the public, naturally compelled scientists to seek an analogue to it for the study of tortuous curves and of curved surfaces. Hence

¹ This brings a new confirmation of the remark of Condorcet which we referred to in the note at the conclusion of the preceding paragraph.

² The lines which the Greeks knew were—omitting the straight and the circle—the three conic sections, the spiral of Archimedes and the analogous spherical curve, the conchoid, the cissoid, and a quadratrix, besides a tortuous curve of Archytas, the hippopede of Eudoxus, and the cylindric helix; to which others may be added when certain historical questions still pending have been solved in a sense favorable to the ancients. To these lines the moderns have added various species of hyperbolas, of parabolas, of spirals (for instance the logarithmic) and of quadratrices (among which is conspicuous that of Tschirnhausen), then the folium and the ovals of Descartes, the cycloid, (see Günther in *Bibl. math.*, 1887), the loxodrome, the elastic curve, the catenary, the cardioid, the epicycloid and hypocycloid, the ovals of Cassini (in particular the lemniscata), the sinusoid, the logarithmic curve, the *versiera* of Maria Gaetana Agnesi (1718–1799) (*Intituzione analitiche*, Milano, 1748, 1, p. 380), certain plane and spherical curves at which Guido Grandi (1671–1742) arrived while trying to solve the famous Florentine enigma (see the work: *Flores, geometrici*, etc., Florence, 1728), then others which Vincenzo Viviani and a friend of his proposed as auxiliary in the solution of the problem of Delos (see *Quinto libro di Euclide, ovvero scienza universale delle proporzioni spiegata colla dottrina del Galileo da V. V.*, Florence, 1647), the parabolic spiral, (see Weyер, *Ueber die parabolische Spirale*, Kiel und Leipzig, 1894), etc., etc. For greater details see Brocard, *Notes de bibliographie des courbes géométriques* (Bar-le-Duc, 1897 and 1899).

the stimulus to the generalisation for space of the method of co-ordinates which, as we said, did not escape Descartes, and which Schooten noted explicitly in the last book of his celebrated *Exercitationum mathematicarum* (1657); hence the origin of the idea of Parent (1666-1716)¹ to represent any surface by means of an equation between the three co-ordinates to any of its points.²

This period of preparation of analytical geometry of space is followed by the first period of development, in which figured as leaders Clairaut (1715-1765) and Euler (1707-1783).³ Clairaut in 1731, when only sixteen years old, published a *Traité des courbes à double courbure*, that was considered worthy of being admired as a marvel of imagination and of ability, in which are solved with rare elegance many of those problems relative to the curves of double curvature which have their analogues in the plane, and others then entirely new. Euler supplied an *Appendix de superficiebus* to the second volume of his celebrated *Introductio in analysin infinitorum* (Lausanne, 1748), in which appendix he not only gave some general propositions concerning the analytical treatment of the theory of surfaces, but made an important application of it to the study and classification of the quadrics. This same famous scientist by the memorable "Recherches sur la courbure des surfaces" (inserted in the *Mémoires de l'Académie des Sciences de Berlin*, 16, 1760) laid the foundations for the study of the curvature of a surface in one of its points, giving his own name to a relation which, by the continual use made of it, is very familiar to all those who are even slightly occupied with mathematics.

To the second half of the eighteenth century belongs also in a large measure the gigantic scientific work of Monge (1746-1818),⁴ who, after having given to the analytical geometry of the plane the

¹ Fontenelle, *op. cit.*, 1.

² *Essais et recherches de mathématique et physique*, 2 (Paris, 1713).

³ N. Fuss., *Éloge de M. Euler* (St. Petersburg, 1783).

⁴ I cite here the works inserted in the *Mém. des Sav. étrangers*, 7, 1776 and 9, 1780, and in the *Mém. de Paris*, 1784, and also those which are found in the *Miscellanea Taurinensis*, 5, and in *Mém. de l'Acad. de Turin*, 1. Of the *opus magnum* summarising and completing such works, we shall not speak here.

aspect which it retains in great measure to-day, using systematically the equation of the straight line, introduces the idea so important of *family of surfaces*, and, studying some special families ("Surfaces moulures," ruled, developable, tubular, etc.), disclosed to view a connection intimate and unexpected, because remote, between the theory of surfaces and the integration of partial differential equations, which, illumining both doctrines, revealed to geometers new resplendent horizons.

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(TO BE CONTINUED.)

THE COSMOLOGY OF THE SUMERIANS.¹

ACCORDING to the Sumerian conception the earth as a WORLD-EDIFICE consisted of THREE PARTS:

- (1) The heavenly ocean or AN.
- (2) The terrestrial ocean or KI.
- (3) The *uṣṣarraqi'a²* or LIL, which stands between the AN and KI.

These three parts were assigned to the *first triad* or *rahṭ* of the Sumerian pantheon, i. e., to Anu, Ea, Bel. To these as such belongs the *world-edifice*.

As there existed a heavenly and a terrestrial ocean, so the LIL or *uṣṣarraqi'a* was considered also under a double aspect:

- (a) As a heavenly *uṣṣarraqi'a* or AN = shamū, *šamāt* (*shamaim*) or "heaven."
- (b) As a terrestrial *uṣṣarraqi'a* or KI = irtsitu, *ṣar* (*arets*) or "earth."

The former keeps back the heavenly and the latter the terrestrial ocean.

This latter consideration gives us the so-called TWOFOLD division of the earth as WORLD-EDIFICE. According to this it consisted:

- (1) Of the *upper* world, which is AN-ta = elish, i. e., above: *the heavenly world*;
- (2) Of the *lower* world, which is KI-ta = shaplish, i. e., below: *the terrestrial world*.³

¹ The present article consists of the additions to the article of Dr. Radau promised in the last *Monist* (p. 625).

² Translated in the authorised version "firmament."

³ This twofold division is mentioned by Diodorus II. 30, translated in Winckler,

The heavenly firmament or רֶקֶע appears in and is of the form of a "half-circle" or better "plate"—and as the heavenly is only the reflex of the terrestrial, this latter was considered to be the other half of the circle as a whole, i. e., of the firmament רֶקֶע as such. And if the firmament רֶקֶע be round then the heavenly and terrestrial ocean must have the same shape.

The world-edifice is inhabited. The inhabitants which dwell either *in* or *within* the רֶקֶע are ZU, UD, Innanna, Nin-Girsu. Thus they had to become necessarily his, i. e., LIL's children. LIL thus becomes not only the LUGAL or "king," but also the AB-BA or "father" of the gods. ZU, UD, Innanna are the moon, sun, morning or evening-star. Thus we find that even according to Gen. i. 14 the stars are put נְקִיעַת הַשְׁמִינִי, i. e., in the firmament of the heavens. Each one of these stars has his abode and special sphere not only in the terrestrial¹ but also in the heavenly רֶקֶע. When they are in the latter they are visible, but when in the former they become invisible. The *road* they had to travel when in the heavenly רֶקֶע was marked out for them by the so-called zodiac, which was called in later times *shupuk shamē*,² i. e., "the dam of heaven."

The functions of the stars, especially those of the two great luminaries are according to Gen. i. 14, 15 threefold :

- (1) לְהַאֲרֹן עַל הָאָרֶץ
- (2) לְהַכְּרִיל בֵּין הַיּוֹם וּבֵין הַלְּילָה
- (3) וּוֹרוֹן לְאַתָּה וּלְמַוְעֲרִים וּלְמִימְשָׁנִים

"Himmels- und Weltenbild der Babylonier" (*Der alte Orient*, III.), p. 62, with these words: "Von diesen beobachten die Hälften (sc. of the 36 gods) die *überirdischen*, die andere Hälften die *unterirdischen Stätten*, indem sie über das bei den Menschen und den Göttern geschehende gleichzeitig wachten."

¹ The abode of UD, e. g., is Ud-unug-^{ki}, i. e., "Shamash-abode" or Larsa; that of ZU or Uru: Uru-unug-^{ki}-ma, i. e., Nannar (or Sin)-abode = Ur; that of Innanna: Innanna-ab-^{ki} (or also to be read: Innanna-unug-^{ki}) etc., etc.

² See Winckler, *l. c.*, p. 62 ff.

³ To give light upon the earth. Gen. i. 15.

⁴ To divide between the day and between the night. Gen. i. 14.

⁵ To be for signs. This expresses the *astrologic* signification of the stars.

⁶ And for seasons and for days and years. On the course of the stars, especially on that of the sun and moon the *calendar* is based.

No. 2, i. e., "the dividing between the day and the night" is done by the *sun*. He divides what we call "day" into *two equal halves*—but this he does only on *two days* during the whole year, i. e., at the vernal and the autumnal *equinox*. Where the sun rises on these two days is the *East* and where he sets is the *West*. On these two days it takes therefore just as many hours for the sun to travel over the heavenly as over the earthly *עולם*, or in other words: the sun is just as many hours visible as he is invisible. East and West becomes thus the two points in the *עולם* as a whole where the earthly and the heavenly *touch*, i. e., East and West divide the *עולם* and thus also the whole world-edifice into *two equal halves*: into the upper or heavenly and into the lower or terrestrial world. The East of the terrestrial world is however at the same time the West of the heavenly and *vice versa*, for when the sun rises for the "earth" he sets for the "heaven."

The "*nether world*" or *Hades* was considered to lie in the South, i. e., under that point of the "earth" or terrestrial *עולם* where the sun stands at noon during the equinox. Also the upper world has a *Hades* which likewise was considered to be in the South, i. e., under the same point of the "*heaven*" or heavenly *עולם* indicated by the sun at noon during the equinox. We would get thus in the world-edifice as a whole two points for East, West, and South! The opposite of the South is the *North*. If we would prolong the two points indicating the South towards the North they would (1) meet in *one and the same* point of the line which connects the *East* and the *West* or which divides the world-edifice into the upper and lower world, (2) divide the lower as well as the upper world again into two equal halves. *The point* where they meet is the *North*. The *North* becomes thus not only the centre of the *עולם*, which, as we saw, was considered to be a circle, but also that of the whole world-edifice. Here in this *North*, in this centre "*dwelt the gods*," there also the "*mountain of the gods*," "*der Götterberg*" was situated.

Now we understand the *name* for the *North*. In Assyrian it is called *ishtânu* or *iltânu*, i. e., "*the only one*"—thus called in contradistinction to all the other points, of each of which we have *two*.

There is only *one North* in the world-edifice, this North is the same for the heavenly as for the terrestrial world. In Sumerian the North has the name IM-SI-DI, which Delitzsch¹ translates by "gerade Richtung," i. e., all the radii of the great periphery of "heaven and earth" are directed towards it as the centre.²

If sun, moon, and the stars are in the *yārī*, to what god has to be assigned the region around the centre of the world-edifice, i. e., the space between "heaven and earth"?

Speaking from our present standpoint the space between "heaven and earth" is filled out by the air—hence we might be inclined to assign that region to the "god of the air" to the "*Herrn der Luft*." But there does not seem to exist—either in Hebrew, or in Assyrian, or in Sumerian—a word for "air," at least no such word is known to me. The Hebrew *nān* does not mean "air," but "wind, spirit, breath." The Sumerian LIL is = the Assyrian *zaqīqu*, i. e., "wind, storm," and IM is = *shāru*, which again means "wind." This latter word gives us the right solution. So far we were able to assign all gods to a special sphere or function in the world edifice. One god, however, remained to whom no such sphere has been assigned as yet, and this is Nin-Gir-su or Rammān. He is, as we have seen above, not a star, but the "god of storm, rain, thunder, lightning, and clouds," and must therefore necessarily belong to the region between the heavenly and the terrestrial *yārī*! With this, of course, agrees also Gudea's description of Nin-Gir-su = Rammān, who is said as regards his RI-BA to be like *heaven and earth*! Rammān, the thunderer, fills all the space between heaven and earth and thus reaches from the lower to the upper "firmament." To this space must, of course, also be assigned the seven sons of Nin-Gir-su. They too have as the "seven winds" their abode between heaven and earth.

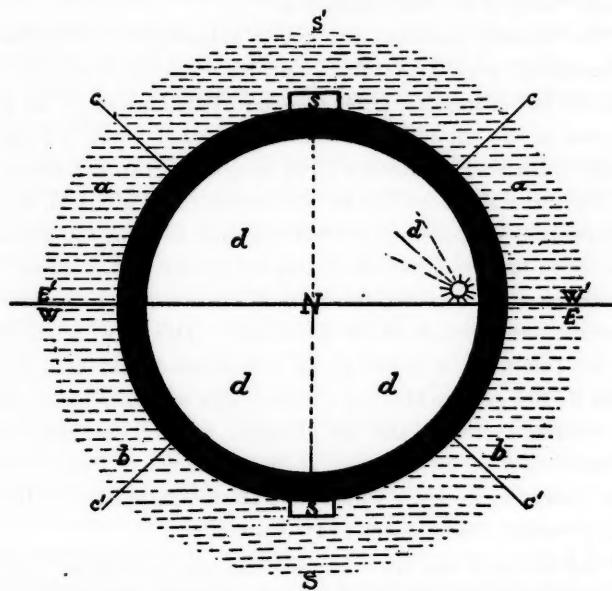
We are thus able to draw the subjoined picture³ of the Sumer-

¹ H. W. B. p. 152.

² See also the E-pa e-ub-7-na! Ub = kibratu, "Weltgegend, -richtung," i. e., "the temple of the seven regions." Gudea, Statue D, ii, ix. (K. B., iii, p. 50.)

³ For another picture see Jenseh, *Kosmologie der Babylonier*, Anhang, Tafel III.

ian world-edifice. (See the explanations given underneath). This picture explains also the following points:



(a) *Heavenly ocean*: AN, Anu; (b) *Terrestrial ocean*: KI, Ea; (c) *Heavenly יְהֹוָה*: an = יְהֹוָה, shamū or heaven; (c') *Terrestrial יְהֹוָה*: ki = יְהֹוָה, irtsu or earth; (c + c') The domain of LIL or Bel. On this יְהֹוָה is to be found the shupuk shamē, i. e., the road which the sun, the moon, etc., had to travel; (d) the domain of Nin-Gir-su = Rammān; (E', W', S') the heavenly world; (E, W, S) the terrestrial world; (E) East of the earth = (W') West of the heaven; (E, W') divide the world edifice into two equal halves, and signify the East and West where the sun rises and sets at the equinox; (N) North, the centre of the world edifice; (S, S') the terrestrial and the heavenly Hades.

1. God EN-LIL or Bel is called very often the "*lugal-kur-kur*." Kur may mean either "the mountain" (*shadû*) or "the land" (*mâtu*). Lugal-kur-kur might thus be translated either by "*king of the mountains*" or "*king of the lands*." Both translations are possible. If the former translation be accepted, "the mountains" would be the *two halves* of the *yrô*. The upper *yrô* or "*heaven*" as well as the lower *yrô* or "*earth*" appear as a mountain

when looked upon from the *North* or *center* of the whole world edifice! *Lugal-kur-kur*, when taken in this sense, would mean literally "*king of the TWO mountains*."

The priestly tradition, commonly abbreviated *P*, informs us (in Genesis xi. 31) that Abraham and his wife and Lot came with Terah his father from *Ur of the Chaldees*. This *Ur* was, as we know now, one of the chief Babylonian cities in early times, it being especially celebrated on account of its temple dedicated to the moon-god, i. e., to EN-ZU or Uru-ki, the first-born of EN-LIL or Bel. It is generally supposed that Terah together with his son Abraham worshipped or were followers of this very moon-god, because they stopped on their way to Canaan in *Harran*, where there was another celebrated temple of the moon-god. This view, no doubt, is true of Terah, for it ought to be remembered that *he* it is who leaves *Ur* and goes to *Harran*, simply taking with him his son Abraham. Terah, therefore, and not Abraham, puts himself again under the protection of his old god while in *Harran*! From another place, however, we know whom *Abraham* worshipped. In Exodus vi. 2, 3—which also belongs to *P*—we read:

"And God spake unto Moses, and said unto him, I am Jahveh: and I appeared unto *Abraham*, unto Isaac, and unto Jacob as El Shaddai, but by my name Jahveh I was not known to them."

From this passage we learn that the *same* god appeared unto *Abraham* as well as unto Moses, but unto the latter under a different *name*. The name had been changed, it is true, at the time of Moses, but the *essence* of that god was and remained the same! Who, then, was this יְהֹוָה, El Shaddai?

The common translation "lord or god almighty" is simply based upon the LXX. *παντοκράτωρ* and the Vulg. "omnipotens," and is as such merely a guess. Two explanations seem possible.

1. Shaddai is derived either from the root shadad (שָׁדָד), "to be dense, to be or to make tight," or

2. It comes from shadah (שָׁדָה), "to be high," from which we have the Assyrian shadû, "mountain."

If No. 1 be accepted, shadad would be a synonym of *raqâ'* (רָקָא) from which we get the *raqî'a*, i. e., something which is or is made

dense, tight,—hence our word firmament! The *ai* at the end represents the old dual ending indicating that there are two firmaments. El shaddai would mean according to this explanation: the god (el) of the two (ai) firmaments or *raqīas*. The god of the two firmaments, i. e., of heaven and of earth, is EN-LIL or Bel. Abraham would thus become a worshipper of Bel, the father of the moon-god Sin.

The second etymology, however, seems to be much better and has already been given by Delitzsch¹ who, however, translates El shaddai on the basis of the Assyrian *ilu shadū'a* by "god is my mountain." This translation I do not think can be maintained. The *ai* at the end of Shaddai must be taken again for the old dual ending, which occurs, e. g., in Shalmaneser II.: "the camels sha *shuna-ai* *tsi-ri-shi-na*, i. e., whose back is *double*." The double *d* stands for *dj*, i. e., the *j* assimilated itself to the *d*.² El Shaddai would thus become "the god of the two mountains," i. e., the *lugal-kur-kur* or EN-LIL, who was the god of the upper and the lower mountain or heaven and earth. El Shaddai accordingly means "god of heaven and earth," or *lugal-an-ki*. Thus even according to this etymology the El Shaddai of the patriarchs is the EN-LIL of the Sumerians. Above we have seen that even *הָיָה* was = EN-LIL, because both when they appear are accompanied by a prime-minister or angel—*הָיָה* by his *מֶלֶךְ* and EN-LIL by his *ur-sag ligga dingir* *Nin-Gir-su*,—i. e., they appear always under thunder and lightning and surrounded by clouds. The statement of P, therefore, that *הָיָה* appeared unto the patriarchs only under *another NAME*,³ viz., El Shaddai, remaining however the same god as

¹ *The Hebrew Language*, p. 48.

² For such a *retrogressive assimilation* of the *j* comp. among others *bunju* = *bunnu* = *bānu*: *zimju* = *zimmu* = *zimu*. Such a word as *shaddū*, given by Del. H. W. B. p. 642 does not exist. The writing *SHAD-di-e*, etc., ought to be transcribed by *shadē di-e*, i. e., *shadū plus two phonetic complements*.

³ Whether *הָיָה* was a name taken from the Kenites or not, would not affect our argument. I myself would see in *הָיָה* simply another name for "rock," i. e., *הָיָה* = "he who is, was, and will be," the "rock" that will not pass away nor change. Comp. here the proper name *יְהוָה יְהוָה* "my rock is Shaddai," the KUR-

before, is thus shown to be fully justified. El Shaddai is thus proved to be an Assyrian name which translates simply the Sumerian "lugal-kur-kur" or "lugal-an-ki"! Abraham coming from Ur where the Sumerian pantheon was fully developed and known becomes thus a worshipper of Bel or EN-LIL the lugal-kur-kur!

The title lugal-kur-kur however is translated in the later Semitic Babylonian inscriptions always by *bēl mātāti*,¹ "lord of the lands." If this transcription and translation be correct, then the idea expressed here would be that Bel as the *firmament* embraces all the "lands" on the terrestrial as well as on the heavenly עיר—for the "lands" are situated in the עיר.

2. The dominion of Bel is sometimes spoken of as a *char-sag kalam-ma* or *shad mātāti* as "the mountain of the lands," and Bel himself is called KUR-GAL² or *shadū rabū*, i. e., "the great mountain." Bel is the god of the עיר, which עיר is, as we saw, a *circle* or a *mountain*. In this mountain or circle as a whole the "lands of heaven and earth" are situated. Bel becomes thus not only "the great mountain" or "circle," the עיר, but also the "mountain of the lands."

3. Later inscriptions speak of a so-called "mountain of the rise of the sun" and of a "mountain of the setting of the sun," which mountains lie in the East and West respectively. The earth being considered as the *lower* half of the great circle called עיר is, of course, at its extremities, i. e., in the East and West *higher* than on any other part. The earth seems to be always *higher* at the horizon than where we stand.

4. The earth as world-edifice in the form of a circle or better globe³ explains the whole system of the Sumerian reckoning, according to which the circle was divided into 360 degrees, the year into 360 days, etc., etc.

GAL (the great rock) and the char sag kalam-ma (the mountain of the lands) of the Sumerians, and see below.

¹ See e. g. Shalmaneser II. Obelisk, l. 3: *ilubēl KUR-KUR*. Or should we transcribe here also "shadai"?

² See Jensen, K. B. III¹. p. 16, note 3, and E. B. H. p. 65, note 1.

³ Consisting of two halves or plates—the upper being put or resting upon the lower.

5. It removes all the difficulties which Winckler still finds in his conception of the Babylonian cosmology.¹

* * *

A few minor points may be added by way of a postscript:²

A strange difference is to be found between the Biblical account of the creation and the Sumerian theogony. According to the latter Sin or EN-ZU, the moon-god, is the *firstborn* of EN-LIL, and hence *precedes* Shamash or UD the sun god. In Gen. 1. 16 on the other hand Shamash is called "the *greater* light,"³ while Sin is named "the *lesser* light,"⁴ thus the former apparently precedes the latter.

What is the reason for this?

Winckler⁵ confesses: "Das babylonische Pantheon stellt nicht den Sonnen-gott, sondern den Mondgott an die Spitze—warum, ist noch unklar." The reason is this: As the chaos preceded the cosmos, as the darkness the light, thus the *night* preceded the day, and Sin⁶ being "he who governs the night," must necessarily

¹See Winckler, "Himmels- und Weltenbild der Babylonier," *Der alte Orient*, III. (1901) pp. 59-65.

²See editorial note in last *Monist*, p. 625.

³נֶמֶשׁ־אֲמָרָה־בְּרַאֲלָה־לְמַאֲלָה־לְמַאֲלָה.

⁴"Himmels- und Weltenbild," etc., p. 65.

⁵Sin precedes Shamash also in the old Arabian pantheon. Our investigation enables us to identify that pantheon with the second triad or *rah̄i* of the Sumerians. Wadd, Sin, 'Amm, Haubas—all names for the Sumerian EN-ZU or Uru-ki, the moon-god, have been correctly identified. The same is true of Athtar and Shams—the former is the *dingir* Innanna, the morning or evening-star, the latter *dingir* UD, the sun—with the difference, however, that Athtar has become a masculine and Shams a feminine. Even in later Semitic *Babylonian* inscription Ishtar as "the morning-star" was, as was pointed out above, p. 39, considered to be a masculine deity. If the old Arabian pantheon represents the gods of the second triad or *rah̄i* of the Sumerians, then an-Karich, Chaul, Anbāj, and Almāqu-hū must be Nin-Gir-su or Rammān. Hommel, *Die südarabischen Altertümern des Wiener Hofmuseums*, p. 28 ff., identified them either with Nebo, because (1) "Anbāj" is a broken plural of Nabiju, which stands for the older Nabi'u; (2) Chaul = פְּנַי "Phoenix" ("der ja vom Weihrauchlande, Hadhramōt, her nach Aegypten fliegt, also ein richtiger פְּנַי oder Götterbote ist"), or with the "Sternenheer" = Almāqu-hū. With regard to an-Karich he is in doubt, thinks however, that this god is "wohl auch" = Nebo.

Above we have seen that Nin-Gir-su is the *ur-sag* of EN-LIL,—hence a נֶמֶשׁ or *minister*, just as Chaul = פְּנַי is. Chaul is here the *minister* of Sin, because Sin is the chief-god, who was even in Assyrian times identified with Bēl (see above p. 50) hence might also have an *ur-sag*! But it is not necessary at all to identify Chaul with the bird Phoenix (see Job xxix. 18 and Herodotus ii. 73); the signification which the root פְּנַי gives on hand, is a much better one. פְּנַי or also לְמַאֲלָה is used in Jerem. xxiii. 19; xxx. 23 of the *storm* and has the signification: *wirbelnd losbrechen hernieder auf etwas* (c. 77). See Gesenius-Buhl *sub voce*. Even in Assyrian we have a root פְּנַי with the signification "beben, erbeben," and a chflu

precede Shamash, who governs the day. This is also the reason why in early times the "day" consisted of "night and day"—accepted even by P: "there was evening and there was morning, the . . . day." This latter, no doubt, is a relic of the Sumerian conception of the day—for among the Sumerians Sin was the *father of Shamash*. The precedence of Shamash represents thus a later stage: it shows P lived at a time when Shamash had been put before Sin. But if the day began with the evening or night, then the *year* must have begun with the *winter*, and the *beginning* of the year could not have been the 21st of March (the 1st Nisan) but must have been the 21st of September (the 1st Tishri). This month Tishri, which signifies "beginning," corresponds, as was shown in E. B. H. p. 295, to the month Ezen *dingir* Ba-u, which was still at the time of Gudea (about 3300 B. C.) the *first month of the year*.¹ According to another nomenclature Tishri corre-

or *Hochflut*, see Del. H. W. B. pp. 274, 275. The god Chaul would become thus the "god of the *stormflood*!" and might be read Cháwil.

Almáqu-hú—thus read by Hommel—is derived from the root **לְמַקֵּה** "to destroy," "to beat." Rammán as the god of *lightning* destroys the wicked. I would like to see in this word a surname of Rammán and read "*almagu-hú*," i. e., "his (sc. Sin's) chief destroyer or warrier = ur-sag lig-ga. To this explanation fits also an-Karich from the root **לְמַהֵה**, Del. H. W. B. p. 352, b: "in Not bringen."

Anbáj too is not a broken plural of Nabiju = Nabi'u—why should there be a *plural* for the name of a god, seeing that this god is only a shajúm?—but also an *elative form* (like almaqu-hú) from the root **לְמַהֵה** and has to be read = *anbaju*. **לְמַהֵה** I would like to take in the sense of **אַבָּה**, Del. H. W. B. p. 442, b. "*hervor-sprudeln, hervorquellen*," from which we get the *namba'u*, "*Quell, Wasserquelle*," and the *imbó'u*, "*vegetation*," and especially *nib'u* "*Spross, Fruchtertrag u. dergl.*" Rammán would thus become as the "god of rain" he who *PRODUCES vegetation*—hence he is called by Shalmanesser II., Obelisk, l. 7: [¹¹⁰Rammán gish-ru shú-tu-ru bél che-gal-li, i. e., the strong one, the powerful, the lord of the *abundance or riches* (sc. of the fields). With this agrees quite wonderfully also the name *ur-dingir Nin-Gir-su*, which name is not only that of an early Babylonian *patesi* (see E. B. H. p. 441 for references), but which also is translated in the bilingual texts by *ikkaru* or *farmer, husbandman*, *Landmann, Ackerbauer, Landwirt*, see Del. H. W. B. p. 58 *sub voce*. *Ur-dingir Nin-Gir-su* literally translated would mean the "dog or servant of Nin-Gir-su." But Nin-Gir-su is = Rammán who as the god of rain is also the god of *fertility*! And what is more natural than that the farmer should be called "the servant or dog of the god of fertility"? This latter name not only proves that our identification of Nin-Gir-su = Rammán is correct, but also that *anbaju* may—nay, must,—have this signification here.

With this then is proven the *Babylonian* origin of the old Arabic pantheon, which was accepted at a time when Sin had become identified with Bel (above p. 50). That the Babylonians indeed influenced the ancient Arabians is proved by the fact that even Semitic Babylonian *words* are found in old Arabic inscription, as e. g. **לְבִתָּה** = libittu, **לְבָנָה** = labánu (this latter is found in one of the oldest hadhra-motic inscriptions from Obne), **מְשֻׁקֵּן** = mushkénu, **סֻנְקָה** = sunqu, see Winckler, M. V. A. G., 1901, 4, p. 70.

¹ Gudea, Statue E. V. 1, 2; G. III. 5, 6: *ud zag-mu ezen dingir Ba-u* "on the New Year's day, the festival of Ba-u."

sponds to the month A-ki-it, which means "New-Year's festival." Tishri is also = the Canaanitish תִּשְׁרֵי which again was the first month,¹ and Tishri is still the New-Year's month of the Jews of to-day. The present Jewish New-Year's month thus goes back to the most ancient times: to the time of the Sumerians.

The creation of Nin-Gir-su = Rammân, the god of thunder, lightnings, rain, storm, and clouds has been omitted by P! The reason is apparent. He did not fit into P's formula. It was impossible to say: And Elohim said: "Let there be thunderings, lightnings, storms, etc. . . . and there were. And Elohim saw that *they were good!*" "*Good*" lightnings, storms, etc. cause quite a "*good*" deal of havoc. Thus not wishing to imply that the Creator might have destroyed something of what he created—P left out the creation of the storm and lightning altogether.

H. RADAU.

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¹ 1 Kings viii. 2. E. B. H. p. 298.

LITERARY CORRESPONDENCE.

FRANCE.

SO extensive is the new work of M. G. TARDE, *Psychologie économique*, that I cannot think of giving a complete analysis of it within the limits of a correspondence. Neither is it incumbent upon me to expound the details of M. Tarde's system, which I have already brought to the notice of the readers of *The Monist*, and, which in the present case we see applied to political economy. It is scarcely necessary to say that these two volumes, which constitute a course of lectures delivered in the Collège de France, are replete with attractive *aperçus*, and will be read with lively interest.

For the traditional division of political economy into *production*, *circulation*, *distribution*, and *consumption*, M. Tarde substitutes the following: *repetition*, *opposition*, *adaptation*,—finding, thus, in the phenomena connected with human wealth also, the three aspects which he has made it his aim to consider in all his investigations. These aspects, in the social *milieu*, appear to him as the immediate expression of human passions, beliefs, and desires in their contact or conflict, at least in so far as conflict is by its results concerned with the life of societies.

The ambition of M. Tarde is always to discover, therefore, behind social, economic, or other phenomena, the individual situations, or rather the intermental action of individuals, or what might be called their psychological mutuality. It would be, thus, the object of "interpsychology" to ascertain the effects resulting from the abstract laws of general psychology, in all the phases of the intercourse of individuals with one another.

So far so good. But the difficulty begins when this method sets up the pretension of constituting all of sociology. For sociology cannot exist unless it have a subject-matter, an object of investigation of its own. Now, the effects which spring from psychological mutuality are new products, original products. If it be true, for example, that the assignment of a piece of land to some one owner, or its division among several, stands for the resultant act of some conflict of desires and passions, it is none the less true that the fact or manner of obtaining possession of the land is an actualised fact, an objective, concrete fact, a solidified fact as it were. And then again, the actualisation of this fact does not depend entirely upon the degree of force or shrewdness displayed by the competitors; it also depends on circumstances of a different nature, on opinions, institutions, populations, etc.,—in fine, on a pre-existent social state. And consequently the entire subject-matter that is genuinely sociological is in danger of escaping altogether the grasp of psychology, or for that matter even of inter-psychology.

It does not follow from what has just been said that I endorse unqualifiedly the common procedure of the orthodox economists; they are unable, despite their aspirations, to rise above a simple description of economical events, and M. Tarde possesses over them the advantage of exhibiting the intimate relations connecting the psychological factor with its measurable products. Will he be successful in tiding over, more fully than they ever have, the descriptive period? This is another matter, and if I am not mistaken, this is the principal matter. As I have repeatedly declared, I can conceive sociology under no other aspect than that of a comparative study of social facts objectively considered,—conducted with a view to discovering how these facts vary as functions of one another, and to define if possible the laws of their simultaneous and successive variations.

By what, let us ask, are the facts to be selected? This is a difficult question, and one that appears to me to offer the true ground of discussion. In any event, we cannot accept as social facts the entities of the economist,—value, labor, wages, etc.,—

abstract expressions under which the actual facts are decomposed rather than classified. But it does not appear that we should be under any consequent obligation, on this head at least, to accept simple psychological states. The very laws of imitation which have been so skilfully utilised by M. Tarde are never more than the means or direct instrument of the individual facts, and it is the resultant of these facts which is alone of interest to sociology. Now, since this resultant, viz., the social expression of psychological phenomena, assumes a thousand forms, the first problem of sociology would consist, I say again, in noting the essential forms in the guise of which other forms are recapitulated, the right being reserved to open special chapters under general titles.

From this point of view, the researches of the older economists cease to constitute an independent science; they are subsumed necessarily under the general discipline of sociology, where the economical facts find their place, for example, under the category of *production*, where the word *production* (the doctrine of the late lamented Ad. Coste) would apparently designate a group of well-defined facts which find speedy elucidation from their relations with other facts.

Does all this mean,—for I have devoted myself almost entirely to objections,—that the two volumes of M. Tarde are not a distinct contribution to our understanding of economical and social phenomena? Far from it. On the contrary, I find them extremely instructive. The criticism which I have advanced is concerned entirely with the reduction of sociology to the terms of a system of psychology, to a schematic situation, of which the three underlying theories are those mentioned above. I believe it is an indispensable prerequisite to the establishment of the science of social facts to abandon individual psychology, and that these facts cannot be explained directly,—even in the brilliant pages of M. Tarde, for whom I have the liveliest admiration,—by simple states of consciousness of individuals.

* * *

M. MARCEL FOUCault, in a meritorious and conscientious work, *La Psychophysique*, has not undertaken to expound and criticise all

the researches now comprised under this name. He has adhered to the meaning of the word which Fechner gave, and looks upon psychophysics as a method of measuring mental phenomena by comparing them on the one hand with physiological phenomena and on the other with physical phenomena, or more precisely (since Fechner was forced to stop at this point) as a method of measuring psychological phenomena (or, as he called them, sensations) resulting from the impressions made by the physical world on the sensory organs.

The examination of the works which relate to this subject is extensive; the work of M. Foucault takes up over 500 pages. I shall simply notice conclusions. The law of Weber is the experimental basis of the measurement of sensation, and consequently the basis of psychophysics as conceived by Fechner. Now, what are we to think of this law? M. Foucault on this point concludes that the "empirical" results of the experiments made with a view to controlling it are unfavorable; they prove unmistakably the law of a *maximum of distinctness* in the majority of perceptions. It is not possible in the present state of our knowledge to say with any certainty what the law is according to which we determine durations, the saturation of colors, and the pitch of sounds. There exist accordingly several empirical laws relating to the distinctness of our perceptions, which it is important to determine; special empirical laws, perhaps, for every species of perceptions, as well as for every class of perceiving subjects. The task set, for a science of psychological phenomena, is the reduction of all these particular laws to more general laws.

The law of Weber appears to M. Foucault to be one of these laws; it is not incompatible with those which appear to contradict it; on the contrary, it assists us in comprehending them. It can only be said, and this reservation is indispensable, that the distinctness of the perception is independent of the absolute force of the excitation, other things being equal. The deviations of the laws of Weber are explained by the existence of the multiple conditions of attention, education, fatigue, etc., which we suppose to be equal, but which are not, especially when the excitations are

very feeble or very constant. In short, it is extremely probable that the distinctness of the perceptions remains constant amid all the absolute variations of the excitations, provided the conditions of perception also remain the same. All of which is tantamount to saying that the distinctness does not depend upon the absolute force of the excitations, but on the conditions of the perception,—conditions which psychophysics should now endeavor exactly to define.

As to Fechner's personal achievement, M. Foucault is of the opinion that this illustrious scientist was mistaken with regard to the true scope and import of his labors, but that they have still been far from sterile in their influence. If the hope of obtaining a rigorous measurement of the intensity of sensations was chimerical, the methods of Fechner nevertheless enable us to measure an important characteristic of perceptions. This measure has now finally, thanks to him, its place in psychology.

* * *

Darwin, as we know, connected phenomena of beauty with sexual selection. M. LUCIEN BRAY, in his book *Du beau, Essai sur l'origine et l'évolution du sentiment esthétique*, accepts this thesis; but he is perfectly aware that it is insufficient to explain the evolution of the sentiment and idea of beauty in man, and *a fortiori*, therefore, the development of the arts which express it. For the physiological basis he accordingly substitutes a psychological basis; and he finds this new basis in the theory of emotion, as that is understood by Lange, James, and Ribot,—a theory still much disputed by scholars such as Binet, Dumas, and others, who nevertheless gladly accept its principle.

As for the physiological basis, certain objections or restrictions are possible. Is it absolutely sure, for example, that the indicatory function of colored organs is the only scientific explanation of the beauty of plants? And what inference can we draw from the supposition that their colorings attract the insects which seek their pollen and so facilitate their fertilisation? Does not the diversity of the types of beauty in animals and men rather militate against the theory of selection? Is it not a fact that the sexual needs pri-

marily accommodate themselves to what they find? And when the choice is made, secondarily, of certain characters, does not such a choice, uncertain and disordered as it is, actually imply a search for beauty in the correct and special sense of that word?

However that may be, we shall have to seek farther and uncover other sources to explain the voluntary beauty created by human art. We may indeed say that whatever there is of life is ultimately reducible to the two acts of *nourishment* and *reproduction*; but it by no means follows that the sentiment and the idea of beauty have been adequately defined by connecting them with either the one or the other of these fundamental tendencies. This is why M. Bray seeks to establish his researches on a broader basis. He speaks of a "tendency to mark oneself off in some manner from one's fellows," a tendency implied in sexual selection which is objectively realised by manifestations of different sorts,—as movements, cries, songs, colorings, and so forth,—and which, when translated into consciousness and attaining a suitable development, is subjectively revealed by that peculiar emotion which is called the æsthetic.

So far so good. But is this tendency, of which the emotion of the beautiful is the psychological equivalent, primitive or derived? M. Bray thinks it is difficult to decide this question. He is not averse to seeing here a combination of the reproductive instinct, either with the tendency to get rid of the surplus of organic reserve which leads to love and to games, or with the instinct of domination, of superiority, or even with both conjointly. And this complex tendency is not equivalent to the sexual instinct pure and simple which we are constrained to transcend.

Once these premises have been accepted, all æsthetics remains to be constructed. M. Bray here feels very distinctly that to explain artistic vocations, to explain art and its evolution, it is necessary to appeal to other factors, and at first to sensorial factors. It is unquestionably interesting to investigate how the sexual instinct permeates our entire psychological life. But so many facts interpose themselves between this instinct and the higher sentiment of beauty that the primitive soil disappears beneath the new ground

upon which myriads of blossoms unfold their petals, the solid rock vanishes beneath the made soil that covers it.

With these remarks upon the main thesis of M. Bray, it remains for me to commend his erudition and the wealth of details which his work contains. I consider it a performance of merit.

* * *

M. DR. G. GRASSET offers us in *Les limites de la biologie* a work laden with quotations and criticisms, from which we can draw much that is of value. What he seeks to demonstrate is that biology is not the sole and exclusive science, which embraces all the others, and, also, that there is no single and exclusive law embracing all other laws. The scope of these two declarations is not exactly identical; there is no doubt but biology does not embrace morals, aesthetics, sociology, etc.; yet we should not forget that man, before becoming a moral person, an artist, or a metaphysician, is an animal which it behooves us to know, and that he not only brings to society his intellect and his soul, but also his body. Again, in so far as it affects the rôle of an explanatory science, biology has done no more than replace physics and chemistry, which sciences had themselves replaced geometry. Every science has fulfilled in its turn the rôle of universal explanation, and the nobility of its effort, however futile we may esteem the result, remains nevertheless its justification before the court of history. But the declaration of M. Grasset involves additionally the condemnation of this explanatory office, of which it would utterly deprive biology. And thereby hangs indeed a tale. I should beg him to consider on this point that monism is primarily justified as a "point of view" merely, and that there exists metaphysical monisms and idealistic monisms as well as material and vitalistic monisms. It is difficult to escape some one or another of these forms of thought, when we endeavor to separate the sciences of the mind from the sciences of matter, and one is soon driven into their fold when one attempts to reach any general conception of the universe.

I specially recommend the last chapter of M. Grasset's little book, which treats of theology and religion. It is the performance of a man of worth and deserves our attention.

M. L. DUGAS, in his *Psychologie du rire*, examines and also rejects all the theories which have been offered for bringing laughter under some single and intelligible point of view; in other words, for making it a true object of science. Laughter, he correctly remarks, is a peculiar phenomenon which is met with in opposing and contrary states; it is an accident and nothing more, and is in itself neither good nor bad. From the moral or aesthetic point of view, the value of laughter consists solely in the mental state of the person laughing, a state which is relative and variable; and in addition, it cannot be evoked by an act of volition: laughter is the instinctive expression of the individuality of each single one of us. It can never be an end for us, it is essentially an end of nature; it is the mask concealing a physiological trigger.

* * *

From M. FRÉDERIC QUEVRAT we have an excellent study, *La logique chez l'enfant et sa culture*, which completes the series of this author's monographs devoted to intellectual education. M. R. P. JULES PACHEU gives us an *Introduction à la psychologie des mystiques*, a subject to which M. GODFERNAUX has just published an admirable study in the February number of the *Revue Philosophique*, to which I refer the reader. M. ALBERT BAZAILLAS gives us *La crise de la croyance*,¹ a work treating of three thinkers: Ollé-Laprune, Balfour, and Newmann. In the latter, who is the most interesting of the three, M. Bazaillas explains and describes the struggle of temperament against the spirit of doubt, and of faith nourished by imagination and sentiment against skepticism based on reason. From M. OSSIP-LOURIÉ, also, we have a work entitled *La philosophie russe contemporaine*, an interesting commentary upon the little known subject of the evolution of philosophical thought in Russia, which has grown predominantly in the three directions of general philosophy, psychology, and sociology. In this latter field will be found the names which are most familiar to us, viz., Karéiev, Lavrov, Krapotkin, Herzen, Bakounine, Kovalewsky, De Roberty, Novi-

¹ Paris, Perrin publisher. The other works mentioned are published by F. Alcan.

cow, Tchitscherin, and Pobedonotzeff. It is not for me to discuss the general spirit which animates the work of Ossip-Lourié; his readers will have to discover that for themselves, and this labor is perhaps the one that will most interest them. The intellectual characteristics of the Russian philosophers are exhibited in his criticisms as clearly as in the works which he criticises; but one would have to know Russia more thoroughly and at first hand to do full justice to M. Ossip-Lourié's work.

M. F. PICAVET, one of our most noted historians of philosophy, has given us a new French translation of Kant's *Critique of the Practical Reason*, with an introduction on the philosophy of Kant in France from 1773 to 1814, and valuable philological and philosophical notes. This translation will undoubtedly be of great service to English readers also, for every translation of the work of Kant requires in certain passages nothing short of an interpretation of the original text. I may add that this second edition is augmented with an *Introduction to the Study of Kant's Ethics*.

From M. LE COMTE DOMET DE VORGES, we have a book on St. Anselm which constitutes a new and remarkable addition to the *Collection of Great Philosophers*. Besides the interest which attaches to the philosophical doctrines of St. Anselm, the history of his life and of his time has many attractive features to recommend it to our attention.

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Just as I was concluding this Correspondence, I received a copy of *Les caractères* by M. FR. PAULHAN. This second edition of this excellent work, of which I have already spoken, contains a new and important preface. M. Paulhan replies in this preface to the objections which were advanced against his thesis, and thus finds occasion for explaining more amply than before the ideas upon which he has based his investigations and the plan which he has followed in his classifications. Classification is not exactly the proper word. M. Paulhan does not classify individuals; he classifies rather traits of character which he then arranges in partial systems; and it is these systems to which he refers by fragments his real individuals, so as to lose nothing of their personality. The

correlation of traits of character being, according to him, an entirely individual affair, he does not attempt to give the "impossible" classification of an individual in a single group, but he aims to classify the system of traits which constitute the individual's personality and which he connects with "systematic series," with a view of "comprehending their scope and value."

Undoubtedly M. Paulhan admirably justifies his analytical method, or method of dissecting the individual; he also well shows the defects which inhere in the synthetic process of classification. He endeavors in the first place to furnish more complete descriptions and better portraits, and only secondarily seeks for the points of contact existing between individuals thus sketched in detail. Yet may not many persons be characterised with some exactitude by one of these partial systematisations—realised in individuals chosen as types, by reference to which the author establishes his abstract groups? Will not the most careful comparison of individuals always tend towards a classification of some simplicity, and must we renounce absolutely all attempts at synthetic classification? This is an open question. Whatever may be the result, this work is upon the whole the best and the most thoroughly worked out of any that we possess in this department of psychology.

* * *

A posthumous work of M. DURAND (DE GROS), *Questions de philosophie morale et sociale*, is given us with an introduction written by M. D. Parodi. I cannot recommend too highly the perusal of this work, which is the last that the really superior mind of Durand (de Gros) has bequeathed to us. M. Parodi expounds with lucidity the thought of the savant and philosopher, and speaks of the man in lofty and sympathetic terms, for which all who learned to appreciate and love M. Durand (de Gros) will join me in gratitude.

Last autumn, another man of great ability was taken from us, ADOLPHE COSTE, in whom I personally lost a dear and excellent friend and the French school of sociology one of its cleverest and most lucid writers. Not long after, in February, occurred the death of MME. CLÉMENCE ROYER, one of the most eminent women that the nineteenth century has produced, and whose conversation, lively and interesting despite the infirmities of age, I always appreciated, even when I did not share its sentiments. To these three noble departed souls, whom to-day I join in single thought, I tender 'the heartfelt homage of a friendship which cannot forget.'

PARIS, March, 1902.

LUCIEN ARRÉAT.

CRITICISMS AND DISCUSSIONS.

NOTES ON CONSCIOUSNESS.

In the following "Notes," whenever I use the word *matter* I use it not as denoting abstract existence or any special mode of concrete existence, but as denoting that objective reality of which we are conscious in experiencing resistance. Let me explain. This reality is not necessarily simple matter. It is energy, whereof the factors, physicists tell us, are matter and motion. Matter may be distinguished from motion as the thing that moves. Motion, on the other hand, may be distinguished from matter as the generic and genesimal change that matter undergoes—a change that may be conceived as originating in the immediate contact of the ultimate particles of matter (giving rise to interaction) in the plenum of the universe. If not thus conceived—if motion is assumed to be an intrinsic property of matter—energy and matter, we must admit, are the same thing. In the view here suggested, motion is a material change arising from the law of stress, operating in the universal plenum. Be this as it may, the product of matter into motion, or of matter into itself through motion (the involution of matter), I hold, name it power, force, energy, momentum, what you will, is the fundamental fact of human knowledge, everything else that exists for man being derived from it, and resolvable into it.

I.

When one billiard ball meets another, the balls are, in a sense, conscious of the impact; that is, both undergo changes responsive to it—the only sense, as I conceive, in which consciousness of any degree is intelligible. These simple changes present consciousness in its lower forms; from which it ranges, through interactions of increasing complexity and integration, till it culminates, so far as our narrow ken may reach, in the consciousness of man. Perhaps the most pregnant feature of these changes, as of the changes of consciousness in every other degree, is that they exist exclusively for the subject of them. The changes in neither ball exist for the other ball, or for any other thing (be it particle or organism) in the universe. It is commonly assumed that this exclusiveness is peculiar to psychical phenomena as they appear in man. It belongs in fact not only to recognised psy-

chical phenomena as they appear in man, but to all phenomena without exception—to all action. Strictly, the universe is one expanse of consciousness, continuous as the sea, though discrete like the waves. The pressure received by the table on which my arm is resting exists for the table alone, as truly as the answering resistance exists for me alone. The molecular transformations which the pressure sets up in the table, and which constitute in philosophical exactness a direct knowledge of the pressure, are for the table, and not for me, or anybody else, or anything else; precisely as the molecular transformations which the resistance sets up in my brain, and which constitute a direct knowledge of the resistance, are for me, and not for the table, or anything else, or anybody else. I cannot occupy the table's center of stress, any more than the table can occupy my nerve-center. The principle of identity forbids this: a thing cannot be itself and at the same time something else. Consciousness, throughout its range (from the infinitesimal to the infinite), may be defined as the change which a unit of any order undergoes, to the exclusion of all other units of every order. This definition, if I mistake not, includes the three traits at once essential and peculiar to consciousness: immediacy, subjectivity or interiority, finality—the first expressly, the other two as corollaries from the principle of exclusiveness. It shuts out self-consciousness, as incompatible with all.

* * *

Consciousness, as we know it in ourselves, seems the orderly yet consolidated revival in organic structure of past affections or impressions, by present ones in unison with them; the revived impressions representing the impressions which through eons have wrought the structure, and reacting on the impressions that revive them. In other words, consciousness of this degree is the state wherein the organism, as a whole, becomes responsive to the behavior of its parts, as parts—wherein the structural register of what is common to all the affections of the organism, yielding the concept of self, interacts with the inferior structures yielding concepts of things, percepts, and sense-impressions—wherein awareness (interaction in its simpler forms) is carried up into personality, through an organic unity higher than that of life—wherein the automatism of life rises, through evolution, into the seeming spontaneity of mind.

* * *

All knowledge is immediate knowledge, or reducible to immediate knowledge. Whatever we know immediately we know as existing, seeing that in immediate cognition the action of the object is unaffected, except by the equal reaction of the subject; and we can no more doubt such action—can doubt it even less—than we can doubt our own existence, for the knowledge of our own existence is derived from it. *Nosco ergo sum.* “I know” implies my existence, to be sure, but not my immediate knowledge of it. The knowledge of my existence presupposes the conception of self, which is formed, like every other conception, by the mediate process of abstraction and generalisation: the knowledge is derivative, not intui-

tive. The foundations of knowledge are thus laid as deep and sure as existence itself.

* * *

What other theory of knowledge offers so high a warrant of certainty as the theory that one thing knows another thing by the direct action of that thing upon it, with its own reaction upon that action? To me this exchange of equivalent activities is the principle of knowing, and at the same time of doing—of transformation, development, evolution. Consciousness in one of its aspects is simple actuality, and belongs to everything that exists, in the exact character and measure of the existence. Change, interaction, actuality, consciousness are but different aspects of the same thing. The interaction of things is the intuition of being, and, hence, philosophically, is knowledge, whether involved in elemental obscurity, or expressed directly in terms of developed mind. Consciousness, indeed, is so completely identified with existence, that a distinctive name for it seems hardly necessary or proper, and, in my opinion, has proved actually misleading. A distinctive name for a universal property could scarcely have proved less than misleading, since it implies that what in reality belongs to everything belongs only to things in a special order of combinations. It is said the Greeks had no term for consciousness until the decline of philosophy, and it is perhaps a fit subject of regret that they ever got one, for it is difficult to see what end it has served, except to handicap philosophy, while making its course darker and more slippery than it might otherwise have been. In the morning freshness and sanity of the Greek mind, the relation between the organism and external nature was felt in its simplicity. The refinements and sophistications that have since obscured the relation are the morbid effects of thinking of it above that which is written. Unfortunately, what deities and demons once were to poetry, hypostatised abstractions still are to philosophy. The machinery of the poets has vanished, that of the philosophers lingers, bright with use, if not unimpaired in strength. Is poetry, then, more congenial to truth than philosophy? Or are the illusions of philosophy more subtle and more deeply lodged? However this may be, it behooves us to bear in mind that what we name consciousness is abstracted from existence. Let us take heed how we assign individual substance to this abstraction, pregnant with significance though the concrete is.

* * *

Two things may be equivalent without being the same, except in kind; and such is the relation of consciousness to the components whereof it is the resultant. The equal reaction with which one atom or one infinitesimal answers the action of another appears to me the seminal principle of consciousness, as of all other forms of existence. Out of it grows the phenomenal universe, comprehending mind in its whole line and scope.

II.

Self-consciousness, as described by the psychologists, is a self-contradiction. For what is it that is conscious? Self, say they. And of what is it that self is conscious? Self, again. Self is thus at the same time both subject and object—an absurdity. Self, they explain, is conscious of its own states; that does not mend the matter. A thing not only is indistinguishable from its attributes but consists of them; subtract the sum of its attributes, and nothing remains. Besides, these states, as manifestations of a conscious self by hypothesis, exist only as the constant sequents of that self; whereby, self becomes its own cause, as well as its own object—the absurdity doubled.

* * *

That which happens to people, when they fancy they are self-conscious in the primary sense of the term, is the focusing of consciousness on the organism, as distinguished from the environment, abstracting the subject from the object, and concentrating attention on the former, the concentration being determined, like concentration in other parts of the field of consciousness, by interest, pleasure, excitement, shock, or whatever else, directly or indirectly, may send a wave of stimulation to one ganglionic center rather than to another. It is to be remembered in this relation, furthermore, that consciousness may embrace without confusion a number of objects at once—as many as six or seven, in the opinion of the elder psychologists—probably several more actually, with its potentiality in this respect yet unexhausted. Obviously, this fact affords within the horizon of consciousness a considerable scope for the play of attention—that is, for the concentration of a single consciousness on various points in various degrees. As respects the possible objects of simultaneous attention, consciousness may be focused on one, or extended with different degrees of concentration to several, or distributed faintly among all. This field of consciousness attention, tethered between subject and object though it is, can be made to traverse from one limit to the other, backward or forward (as attention vibrates between the terms of a relation), without justly exposing consciousness at any point to the charge of transcending itself in self-consciousness.

* * *

A subjective fact and an objective fact are not different facts, but the same fact in different points of view,—the same fact withdrawn by abstraction from the subject and the object alternatively; that is to say, every fact of consciousness is a subjective fact or an objective fact, according as consciousness is concentrated on the subject or the object,—as one or the other of these terms in the relation of knowledge dominates the psychic field. As respects self-consciousness, the distinction between this concentration of consciousness on subject or object, and the concentration of consciousness on consciousness is very broad. In the former, consciousness is concentrated by external agency (external to the individual movement

of consciousness) in a particular part of its field; whereas, in the latter, consciousness is assumed to concentrate itself on itself. The one operation involves only a simple distribution of attention, under the law of causation; the other would violate both the law of causation and the law of identity. One is the sea raised into ground-swallows by storm or earthquake; the other, the sea without wind or shock raising itself into ground-swallows, and precipitating itself upon itself.

* * *

As for self-consciousness, the difficulty is not that consciousness is an ultimate fact (were it so in the fullest sense it would not on that account elude the super-cognition implied in the assumption of self-consciousness), but that it is a fact at all; since no fact can be other than itself, as consciousness would have to be did it react on its own action, thereby becoming self-conscious. The truth is, the difficulty consists in the absence of difficulty. Sheer change, viewed with the existing prepossessions of philosophy, appears naturally an inadequate account or no account of consciousness. Its very simplicity, combined with its immediacy, perplexes observation under such conditions, baffling attention by standing within its guard, so to speak. Yet consciousness, if we consider it well, can have no higher credential to offer; for, though it confronts everything else in its field, it is like the eye powerless to confront itself.

* * *

Self-consciousness and the immateriality of mind are pseudo-conceptions born at the same birth. It is perhaps not easy to say which of these twin illusions first saw the light, but I am disposed to recognise the priority of self-consciousness; which, having as a contradiction no place in reason, must needs be placed in a realm beyond reason, where contradiction is the touchstone of truth rather than of error, and whereof one may say, as Tertullian said of a cherished dogma, "It is certain because it is impossible." Before the date of self-consciousness as a philosophical tenet, the exigencies of philosophy, though giving rise to countless absurdities, had not called for the immateriality of mind, so far as I am aware; but thereat this absurdity became an instant necessity.

* * *

What is called the reflective or philosophical consciousness, and is supposed to be self-consciousness, is a greater complexity, speciality, and range of responsive energy, including a more or less complete independence of the immediate environment, due to the evolution of the species, united with the training of the individual, who by means of it, however, is no more enabled to bring about a consciousness of consciousness, though the psychologists (verbally at least) suppose that he is, than a *gymnast*, by means of athletic training, is enabled to lift himself by his boot-straps, or step clear of his shadow.

* * *

It is this actual, face-to-face experience that constitutes immediate knowledge (consciousness), whether in a particle, in man, or in whatever beings superior to

man the cosmos may hold. The universe is a unit, governed by unitary laws, and the highest being in it is as incapable of self-consciousness as the smallest particle. In this world of unknown possibilities, but of known law, a contradiction is the one thing that we are warranted in pronouncing impossible, unconditionally and forever.

* * *

The view of self as anything else than the psychological self, developed from the unity inherent in the nature of an organism, seems on the point of being abandoned by psychologists themselves. So stanch an idealist as the author of the article on Psychology in the ninth edition of the *Encyclopædia Britannica*, having admitted that "voluntary and non-voluntary attention are fundamentally the same," expressly leaves to the self "only the one power of variously distributing that attention upon which the intensity of the presentation in part depends." This admission appears significant; for, if "voluntary and non-voluntary attention are fundamentally the same," the former is resolvable into the latter, and explained by it, rendering unnecessary, and hence unphilosophical, the assumption of a special entity to explain it. The hypothesis of the self as a conscious subject, distinct from the phenomena of which it forms the center, is thus logically surrendered. It was logically vanquished long ago.

III.

Consider the act of thinking. What is it? The cat lying on the manuscript before me, for example, excites in my brain the common trace left there, and in the ancestral brain, by all the received impressions of cats. This is a perception of the cat: it is a thought,—the realisation of the concept or idea of a class in an individual object of the class. If now the perception of the cat for any reason excite in my brain the common trace of all impressions, of whatever objects, received by me, and by my ancestors to the remotest ancestral form, I realise through an individual of the most general class the concept of self, as the symbol of the common property of that class; which is the perception of the cat rounded out on a higher plane. In the first instance, the thought consists in the idea of a cat, as excited by the individual cat, and is called objective, attention being focused (consciousness concentrated) on the individual cat or object; in the second instance, the thought consists in the concept of self, as excited by the idea of a cat, excited in turn by the individual cat, and is called subjective, attention being focused on the self or subject. An organism receives certain associated impressions (percept); which excite in it the common trace of like impressions received by the individual and its ancestors (concept of the object); which, again, excites the common trace of all impressions, like and unlike, received in like manner (concept of the subject). Here, as I conceive, is the outline of mind,—perception, generalisation, personality; and no immateriality,—no self-consciousness: nothing but consciousness, in terms of interaction, comprehended in the organism that interaction has generated.

The concept or idea, in the view I take, is the symbol of the general trait of a class of objects, revived by the action of one or more individuals of the class on the general trace registered by the whole; and which itself revives the symbol of the most general trait of all objects whatever, by acting on the most general trace which they have registered,—that is, the trace of their common relation to the organism. These symbols are not psychical, in the sense of being hyperphysical. The nervous trace or register of psychical states has no psychical counterpart in that sense, but of itself, when excited, revives the more recent or intense of the psychical states that have wrought it, and which themselves, like all other states designated psychical, are in reality special modes of material nature,—physiological states, integrated and transformed in the highest co-ordinating center of the organism. In consciousness the object has no counterpart, except the subject, whose interaction with the object it is that constitutes consciousness,—distinguished conveniently as psychical, but which, as the product of physical factors, is itself physical, distinguishable from its factors in form only.

IV.

Relations in the environment set up in an organism (arising itself from secular interactions) corresponding relations, either term of any one of which, according to physical laws, revives the relation, and with it, more or less vividly, the group of relations to which it belongs, and which it thus symbolises or represents, exhibiting therein the first lines of the division of general awareness that we distinguish as mind. In short, the fact of purely physical association is the immediate source of symbolism in its whole import; which import is less intelligible in man than in the amoeba, the orchid, or the crystal, only because it is more extensive, more various, more complex, more independent of direct impressions, more remote in general from the elementary state, but which in all is at bottom qualitatively the same.

* * *

The progressive integration of molecules with like molecules to the exclusion of unlike ones, in a solution of several salts, has the same kind of meaning,—is in all essential respects the same operation,—as the progressive integration of impressions with like impressions, to the exclusion of unlike ones, in the nervous masses: crystallisation and generalisation are but different exemplifications of the same process. In crystallisation, unlike generalisation, it may be said, there is no recognition of the likeness of the integrating units. How is that? Under a physical law, the necessary condition of admission into the forming crystal is likeness. The integration of the units, therefore, is itself a recognition of the likeness. Integration and recognition are two aspects of one act. Actions speak not only louder than words, but before words exist.

* * *

The paper-weight that I hold in my hand I am compelled to think as one with my consciousness of it, in the ultimate analysis of both. I am conscious, it will be

admitted, that the energy which I exert in lifting the paper-weight, and the resistance of the paper-weight, are equal; but the relation of equality presupposes the relation of likeness in kind. Hence, I cannot be conscious that two things are equal without being under the necessity of granting that they are connatural,—not necessarily the same in form or mode, observe, but the same in nature. Nor does this necessity, if accepted, lead to inadmissible consequences, as Mr. Herbert Spencer thinks. Mr. Spencer herein appears to overlook the true meaning of form as distinguished from matter. A paper-weight and my consciousness of it are immensely different in form, yet I am bound by an absolute necessity to believe that they are the same in matter. If, indeed, a simple proposition which I am compelled to accept is not true, what is true? Not certainly my own nature which in this case would compel me to accept a lie.

* * *

The state of consciousness is simply a transformation of the resistance of the paper-weight, differing from it, relatively, in the same manner that one allotrope of an element differs from another, or one isomer differs from another. As terpene, for instance, is the common substance of the essential oil of lemon and the essential oil of orange, or as carbon is the common element of charcoal and the diamond, so is mechanical force, in a sense more recondite (revealed by a deeper analysis), the common substance or the common element of the paperweight and the state of consciousness. The two forms of the force are different, the force itself, and the quality of the force, are the same in each; and we are disabled from thinking of the force as subjectively and objectively different, it seems to me, not in the first instance, as Mr. Spencer assumes, because the conception of mechanical force is the most general of our conceptions,—for, manifestly, if it were not real, the mere generality of it would offer no barrier to thought—but first of all because our cognition of mechanical force is not a conception, but an intuition—an immediate cognition—a simple consciousness—which necessitates the identity of the object in consciousness and the object in existence; for the activity of the object and the counter-activity of the subject, wherein the cognition consists, are axiomatically equal. Besides, were the object in consciousness and the outer object not the same, the cognition, in lieu of immediate, would be mediate, inasmuch as the former object, not being the object of consciousness (that which by interacting with the subject makes consciousness), would have to be the subject interacting with itself, or, what is equally inadmissible, a representative of the object without the credentials of interaction, and the possibility of immediate cognition would disappear: the condition supposed would subvert consciousness.

* * *

The disability [to think of mechanical force as subjectively and objectively different] which Mr. Spencer undertakes to explain away is coeval with thought. It is not secondary, but primary—not a product of experience in the ordinary sense of the expression, but the subjective obverse or reverse of an objective impossibil-

ity. It has been generated in us by the absolute uniformity of our experience, superadded to that of the experiences of ancestral forms running back to the simplest of these, being the register of a uniformity in external nature, uniformly repeated by millions of generations. The limitation is organic, existing in the first cognition of the developed organism, in as full vigor as in the millionth or decillionth. That a thing is itself and not anything else is a truth which, once distinctly cognised, can receive no confirmation from repetition, though the repetition were infinite. We realise our inability to conceive the negation of it, not after scaling a towering hierarchy of abstractions, but with our first step on *terra firma*.

* * *

The human mind is organised and evolved responsiveness—a comprehensive reflex of the outer forces and relations that have moulded it. Fundamentally, all psychic action is reflex action, no matter how multiplied or how complicated—Shakespeare's intellection no less than a rhizopod's feeding; and reflex action is mechanical action. The impression of a rose, received by the senses, modified and transmitted by the nervous centers, and discharged in plucking the rose, undergoes the same general change as the impulse of a breeze, received by the vanes of a windmill, modified and transmitted by the axes, wheels, and other gearing, and discharged in lifting a bucket of water; or as the pressure of the mainspring of a watch, received by the barrel, modified and transmitted by the wheelwork, escape-movement, and balance, and discharged in pointing out the time of day. The mechanism, whereby the force is transformed and carried from the point of application to the working point, is relatively simple in the last two cases, and surpassingly complex in the first case, but in all the cases equally the operation is mechanical—the enormous difference in degree may obscure but cannot alter the identity in kind.

* * *

The intelligence of man, the selection of plants, the motion of inanimate things (so-called), are all to my view fundamentally the same: the first may be resolved into the last, the last (granting suitable conditions) involved to the first. An apple on the tree, pulled by gravity, held by cohesion, and falling or sticking as one form of energy or the other prove the stronger, is (not in the eye of fancy but in philosophical soberness) a type of human conduct in its utmost reach and diversity—exhibits in a rudimentary form what in man is called perception, reason, will. With respect to the quality known as psychical, the sole difference between Newton, and the apple that he watched in the garden at Woolsthorpe, is a difference of degree. At no point in the vast scale can one say, "Here the physical falls short, and the hyperphysical completes the evolution." Philosophically, the entire system of things is for man, I doubt not, a question of physics. As the profoundest demonstration in mathematics may be resolved into steps so short and easy that a child can take any of them, so those steps, I am convinced, may be resolved into reflex actions, which in turn may be resolved themselves into simple reaction.

Although the development of mind from what we distinguish as matter is hard to realise in the existing stage of human experience, the thing we call matter is a fact, and a fact, moreover, to whose capabilities no limit is assignable; whereas, the immaterial entity or nonentity, invoked to supplement the alleged incapacities of matter, is not only not a fact, but infinitely the reverse, admitting of neither comprehension, nor apprehension; it is a mere creature of ontology,—of metaphysics twice removed beyond the bounds of sense. The choice, then, lies between a fact of illimitable capabilities, and a figment incapable of representation in thought.

* * *

Mechanical force, or the reality which we know under that inadequate and deceptive name, is something; that which is not mechanical force, or cannot be reduced to some sensible form of it, actually or ideally, is nothing. Mechanical force, as I here said, is not simple matter. Nor is it simple motion. It is matter in motion—energy—the only state in which either matter or motion can be directly cognised by man. Matter is the body of energy, motion the soul. Energy is existence.

* * *

No effort of consciousness enables us to assimilate consciousness and motion, it is said. True; for to assimilate consciousness, and motion in some other form, would be to make consciousness conscious of itself, as well as of the antecedent motion, since the consciousness of a relation implies a consciousness of both terms of the relation. When one thinks he is representing in consciousness a unit of consciousness, side by side with a unit of motion or anything else, he deludes himself. He is conscious of only one term of the fancied comparison; to be conscious of the other term—a unit of consciousness—he would need the standing-place that Archimedes postulated as the condition of prizing the earth from its orbit.

v.

If we would avoid the radical contradiction of psychology, modern and ancient, I can see no stopping-place short of the conclusion that the processes of the brain which we call mental, save consciousness only, are strictly not mental at all. On the contrary, they seem to stand outside of the central consciousness, albeit structurally correlated with it, and ready functionally to enter it under the requisite stimulus. They might be called sub-conscious, as belonging to the separate consciousness of sub-centers of the brain, but not as belonging to the distinctive consciousness of man, except when they actually enter into its sphere from without, like other external objects. Sub-consciousness, in any other sense, has to me no meaning. If the word is to be used without impropriety, it can mean only unconsciousness. Provided an object is out of consciousness at all, it matters not, so far as outness is concerned, whether it is under or above consciousness—whether it is stationed at the door, or stands so remote that it may never reach the threshold.

The human organism, like every other organism, below or above it in the scale of being, may be regarded as consisting of interdependent organisms or systems of organisms, each with its own center of consciousness, subservient to that of the organism or system of organisms next above it, with which as subject it interacts as object, but of which it is not otherwise a subconsciousness. When we speak of being subconscious of this thing or that, we in fact are conscious of it vaguely or dimly, not unconscious of it. To say that we are conscious in any manner or measure of what is below the threshold of consciousness is an arrant contradiction. Feeling, for instance, to return, is one of the great parts in the trichotomy of mind to which Kant set the seal of authority, and some psychologists maintain that the other forms of consciousness, in that famous division, are developed from feeling. Psychologists agree, however, that there can be no feeling without consciousness, and also that what some of them call the correlative of feeling is physiological. What is this but saying that feeling is the consciousness of this physiological correlative? Every psychical state has a physical factor or so-called object. If, as all admit, a feeling is a state of consciousness, what is the object or objective element of the consciousness? A pleasure or pain is undeniably a psychical state. What is its physical factor or object? Not the feeling itself, for that is psychical, to say nothing of the impossibility of being its own object. What then? What but that which psycho-physiologists call the physiological correlative of feeling? In my judgment, we are bound to identify feeling with cognition, under penalty of contradiction. When I smell a rose, the odor stimulates my olfactory center, and the consequent pleasure I experience consists in the consciousness of this stimulation, just as the perception of red consists in the consciousness of the corresponding stimulation of the optic center. Pleasure and pain, with all intermediate feelings, consist as exclusively in the consciousness of their several objects or physiological counterparts as acknowledged cognitions do. A pleasure or pain is the consciousness of its object, be that object localised or unlocalised, as the perception of a tree is the consciousness of its object; and the object of the one consciousness is no more or less subjective than the object of the other. Psychologically, the only difference between the feeling and the perception is the difference between the objects (physiological correlatives) of the two states or acts of consciousness, the object of the feeling being one mode of the nervous system, the object of the perception another mode; the feeling and the perception alike are cognitions. And what in this respect is true of feeling is equally true of cognition, which is but a mode of feeling, the will being at most the resultant of a complex of feelings. There remains only cognition; to which, on a just analysis, all the mental phenomena, I am persuaded, will be found reducible. Mind is a special form of energy, and, on the energy of mind passing into another form, the mental form does not pass with it—the energy alone passes; wherefore, in that other form the energy is not mind, any more than heat is light, though it may readily pass back into mind, as the energy of either of these may pass into the other. In fine, mind is the functioning of

the organism as an organism. When the organism is not thus functioning, the mind is not actual, but simply possible; it exists not *in actu* but *in posse*. It may revive in greater or less degree the next instant, or it may never revive in any degree; but, which ever occurs, the mind in the interval or the stretch does not actually exist. It exists potentially, if at all.

VI.

The mechanism of intelligence, as might be inferred *a priori*, appears most distinctly in the lower classes of the animal kingdom, whose inner and outer relations are so few and simple as not to obscure the character of their mutual adjustment. A turbellarian worm, for example, is shadowed by an object, which it presently touches, and draws back: a visual impression is followed by a tactual impression, both of which modify the vital processes of the worm, the tactual impression modifying them in such wise that the resulting contraction takes the creature away from the obstacle. The several terms of this series—the visual impression, the tactual impression, the recession—become in the course of verian experience indissolubly associated with each other (the laws of association confessedly govern all nerve-tissue), so that the third term appears to follow the first without the intervention of the second, motion being transmitted in regular succession instantaneously through the consolidated series, as through a recognised train of mechanism; whereby eventually the turbellarian, on feeling the shadow, recoils at once, without staying for the actual touch to make it recoil, as a man walking a railway, on seeing the coming train, gets off the track, without staying for the train to knock him off. No biologist will deny that this effect, in the case of the worm, is due to changes in processes purely physical, subject to the physical law of association; yet here, rudimentarily, is perception, representativeness, volition—the impression of a shadow; the inseparable association of that impression with the impression of the touch that follows it; the like association between the recession and the impression of the touch that precedes it, the recession, be it noted, following the shadow meditately in reality, immediately in appearance—that is, what in man we would say was the recognition of the shadow as a signal of retreat, and the consequent retreat, which the touch would have enforced if the worm had not prudently anticipated it, all of which is really true of the worm in a rudimentary sense: here in fact, clear of everything immaterial—clear of everything not mechanical—is incipient mind on the highway of evolution, already beyond the first stage, and travelling at speed. The correspondences between the turbellarian and the environment are limited in space and time, few, immediate, simple, unspecialised, co-ordinated in a low degree, loosely integrated—were it otherwise they could not exhibit the fundamental characteristics of intelligence in such clearness and distinctness; yet, develop the correspondences in these several particulars, and you pass from turbellaria to man, in the bewildering complexities of whose intelligence the simple characteristics of it seem lost.

Whatever difficulty one finds in taking the view of mind I have indicated (and to the average person the difficulty at the first blush may seem insuperable), he will do well in his suspense, if conscious of suspense, to anchor his judgment in the broad truth that the phenomena of mind, without exception, are subject to the law of causation, the negation of which is unthinkable; and, here, patiently ride at anchor, till at some new stage of experience, or some new reach of training, the fog shall lift from the sea, and the sun light up the shore. Be the night short or long, the land is there, and the morning will reveal it.

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SPENCER'S DEFINITION OF EVOLUTION.

It is a hazardous venture to call in question so basic a formula elaborated by such a master of the subject as the definition of evolution and dissolution laid down by Herbert Spencer. Yet as philosophy and science acknowledge no pontiff, the privilege of raising a question is at least open, and it may even be that finality is not yet reached.

Spencer's celebrated definition of evolution, although well known, may be repeated here:

"Evolution is an integration of matter and concomitant dissipation of motion; during which the matter passes from an indefinite incoherent homogeneity to a definite coherent heterogeneity; and during which the retained motion undergoes a parallel transformation."

His conception of dissolution is the converse of this,—"the absorption of motion and disintegration of matter."

To establish and illustrate his definition of evolution, Spencer utilises such cases as the evolution of a solar system from a nebula, of a living organism from its ovum, of complex civilisations from crude social states, and numerous others.

In these instances the definition applies perfectly. The evolution of a solar system from a nebula, for instance, is a typical integration of matter, with a passage from an indefinite incoherent homogeneity to a definite coherent heterogeneity. But how about the evolution of the nebula? Can the same formulae that fit the evolution and dissolution of a solar system apply to a nebula? Apparently not; on the contrary, the two formulae would appear to be exactly reversed.

No final theory as to the origin of nebulae has yet been formed; but if the common notion, which too has been countenanced by Spencer, that they arise from the collision of stars approximates the reality, then the evolution of a nebula consists in a dissipation of matter and an absorption of motion,—the reverse of the definition.

On the other hand, the dissolution of a nebula is brought about by the very process by which a solar system is formed from it. The transformation of the

nebula into the solar system constitutes the evolution of the solar system, but it is also the dissolution of the nebula. The process is one and the same; but it has a double aspect. From the standpoint of the nebula it is dissolution, from that of the solar system it is evolution. Here, then, is a clear case in which a process of dissolution, that of a nebula, consists in an integration of matter and a passage to a definite coherent heterogeneity,—precisely the reverse of Spencer's definition.

A single exception to the truth of the definition is sufficient to overthrow its universal validity. Similar considerations when applied to other instances of evolution, will, however, yield results similar to those in the case of the nebula. The evolution of an organism from an egg is one process of dissolution of the egg. The transformation of a series of organic forms from one species to another is the evolution of the subsequent species but the dissolution of the precedent species. In the passage of a people from a simple social state to a complex civilisation, the evolution of the civilisation follows the lines of Spencer's definition; but the same process brings about the dissolution of the simple society. Thus, the transition from feudalism to modern democracy was the evolution of the latter but the dissolution of the former.

In general, evolution and dissolution are the same process, viewed from different sides. The universe is made up of physical and psychic elements undergoing continual change and rearrangement. The transformation of one order or arrangement of things to another order or arrangement is both evolution and dissolution; it is the dissolution of the preceding order, but the evolution of the succeeding order. There is but one process of change from any one order to the next succeeding order of things; sometimes the transition is an integration of matter, sometimes it is a dissipation of matter. Evolution therefore is sometimes an integration, sometimes a dissipation; and dissolution is the reverse aspect of the same process.

As the cases of evolution and dissolution are exactly equal in number, Spencer's formula of evolution and dissolution according to this conception would each seem to hold good for just one half of the cases of cosmic transformations. The two definitions are complementary, reversible, and interchangeable, and to complete their applicability they would have to be conjoined.

This analysis would seem to reduce the process of evolution to a simple continuous mechanical flux and rearrangement of the material and psychic elements of the universe that is always and everywhere going on, and to take from the conception of evolution the idea of progression that is generally accepted as being implied in that of evolution. This implication of progress is, however, somewhat illusory. In the first place, there is no absolute or universal standard by which progress or regress can be judged. For purposes of convenience or in our intellectual vanity or shortsightedness we may establish ideals or standards; these standards may be useful for a time, but with changing conditions they become altered or obsolete. Again, the idea of progress is apt to assume a teleological tone, and

thus to become a discordant element in a philosophy and science based on immediate causes alone.

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THE RISEN CHRIST AT DAMASCUS.

In any consideration of Jesus's resurrection appearances, whether to the disciples or to Paul, it is well to make a distinction between the vision hypothesis and the apparition hypothesis advanced in explanation of that remarkable series of events. The term *vision* is commonly used of what is seen in a dream, ecstasy, trance, or the like, and especially of experiences of a purely subjective nature. The term *apparition* is more suitable in those cases which seem to be accompanied by none of the abnormal psychical conditions, and in which the impression of the objective reality of the appearance is more strongly and vividly felt by the percipient.

It is unnecessary to dwell upon the supposition that Jesus's death on the cross was only apparent and that he was afterwards so revived that he was able to appear again among his friends: for although this grotesque hypothesis has been often accepted as explaining the appearances to the disciples, it could certainly not account for the appearance to Paul at Damascus. So also the rationalistic explanations of Renan and others, of a storm on Mt. Lebanon, a flash of lightning, or a sudden attack of ophthalmic fever, need not concern us here. The view that Paul was stricken with sudden blindness in which he recognised the arresting grace of God¹ is ingenious, but is unsatisfactory in important particulars, and also finds little support in the evidence given by Acts, chap. xxvi, the passage containing the earliest account of the event outside of Paul's own writings. And again, Baur's method of proving from the Acts accounts, without regard to Paul's testimony, that the appearance was simply visionary and was later transformed into a myth, is now generally rejected.

The vision hypothesis in varying form has been advocated by such scholars as Holsten, Hausrath, Pfeiderer, Weizsäcker, and Holtzmann. Their conclusions always rest upon a large basis of truth, but are generally to be regarded with suspicion in proportion as they affirm the simply naturalistic character of the event. The hypothesis of Holsten combines the usual features of the vision hypothesis with certain other ingenious elements, and rests upon three fundamental propositions: (1) That Paul made no distinction between vision and supernatural reality; (2) that the later visions of Paul were essentially similar to the appearance at Damascus; (3) that the previous Christophanies to the disciples were visions and regarded as such by them and by Paul. Stated more fully, Holsten's theory affirms

¹ Matheson, *Spiritual Development of St. Paul* (1890).

that visions were currently regarded as the chief means of divine revelation and that their objective reality was never questioned. According to this view, for instance, the distinction made in Acts xii. 9 between a vision and an actuality is not a distinction between bodily and spiritual realities, but merely between realities conceived of as existing in the earthly or heavenly state. In other words, the Jews regarded a vision as an objective heavenly reality and not a mere symbol of something else. Accordingly the Christophanies were believed to be visions having objective reality and giving assurance of Jesus's resurrection and life in the heavenly state. To express this still differently, the disciples believed that Jesus had left his earthly body in the tomb and had after his resurrection been clothed in a heavenly body of light by means of which he was able to appear to men on earth, thus indicating to them his resurrection. And let it be all along remembered that these were really subjective visions (according to Holsten's view), arising in the disciples' minds from a sub-conscious conviction of the truth of Jesus's resurrection, and having all the appearance of objective reality. And, as admitted by Holsten himself, such visions would lead to but one conclusion, namely that Jesus was in the heavenly life with God. That they would indicate Jesus's bodily resurrection is not a part of the hypothesis, which is bound to deny this belief to the apostles and attribute it to later tradition.

The basis of truth underlying the vision hypothesis must not be disregarded. Paul himself was subject to visions, especially in the important crises of his career; and that these visions were apt to be of an ecstatic character is quite evident in 2 Cor. xii. 2-4, where the apostle testifies that on one such occasion he was unconscious of his own bodily presence, and like the East Indian "adepts" entered a state of "illumination" in which he heard words which the world was not ready to receive. But on the occasion of his conversion what a combination of circumstances favorable to an ecstatic experience!—the fatigue of the long journey across the desert beneath the noonday sun; the remembrance of the odious work of persecution which was now to be renewed; the fruitless struggle for righteousness in contrast to the joyous confidence of the Christian martyrs; finally, the lingering recollection of the dying Stephen and his vision of the glorified and ascended Christ. How gladly would Paul be convinced, if he could but surmount the difficulty of the resurrection! (Holsten, Pfleiderer.) Then moreover, "the pure bracing air of the desert produces an extraordinary elation of mind. The very sanest seldom escape without hallucinations."¹ How natural, then, that all these circumstances should unite in raising before Paul's eager imagination a glorious image of light in which he recognised the heavenly Adam, "the man upon the clouds," the Messiah himself risen from the dead!

Now much of this representation must be acknowledged as true; but the bearing of such facts as these must never be lost sight of. In Paul's case the condi-

¹ Sprenger, *Mohammed*, I., 216.

tions were exceedingly favorable for witnessing an extraordinary phenomenon, and under other conditions the event might have assumed a very different form. These circumstances, therefore, are to be taken into account in explaining what occurred; they are the natural conditions, and natural conditions are required for every event that ever takes place. But supernatural conditions are also required, for all events have both a natural and supernatural aspect at one and the same time; and any hypothesis which disregards this fundamental principle is to be rejected at the outset.

The arguments ordinarily adduced against the vision hypothesis are to a large extent worthless. Especially is this true of the attempted contrasts between Paul's other visions and his experience at Damascus. Thus we are told that elsewhere Pauls shows the greatest reluctance to speaking of his visions, but that he makes it his loudest boast that he has seen the Lord.¹ Whereas Paul would very naturally give the latter event full publicity, since it was the guarantee of his apostleship and the one circumstance which placed him on equal footing with the Twelve. Again, we are reminded that Paul in his ecstatic trances felt himself snatched up into paradise, but that at Damascus he had no such experience—as if the ecstatic state were bound to result on each occasion in the same or similar sensations without variation in imagery or vividness. Further, Beyschlag argues from Paul's three days' blindness that there must have been an objective reality; although it is now well recognised that hysterical blindness is one of the ordinary symptoms of the ecstatic condition.² Beyschlag also cites Paul's vivid recollection of the exact time and place of the Christophany as an evidence that it was not a mere ecstatic vision—as if it were not a usual matter for Paul to remember years afterward the exact circumstances of his visions, whether at Troas or Jerusalem. It is also pointed out that Paul was a man who urged the necessity of testing the spirits of ecstatic revelation,³ and that accordingly he could have made no mistake in regard to the nature of the appearance at his conversion. As a matter of fact, the dividing line between true perception and illusion or hallucination is often impossible to determine, and the ecstatic trance occurs in every degree of intensity from the slightest aberration to the most profound catalepsy.⁴ Indeed, the most cautious observers are often found to be the victims of the most unaccountable delusions. And finally, when it is urged by Beyschlag, Krauss, and others, that a vision could never have led Paul to a belief in Jesus's bodily resurrection, we can only say that it would be difficult for a vision to produce such a belief, but certainly not impossible. As a whole, the refutation of the vision hypothesis has called forth many misdirected efforts which have proved nothing except the superfluous zeal of their authors.

¹ So Weiss, Paret, Sabatier, Godet.

² See James, *Principles of Psychology*, I., 206.

³ 1 Cor. xiv. 29.

⁴ Bernheim, E. Gurney, Baldwin, James, Sidis.

And further, in the case of Holsten's hypothesis, it is useless to argue, as Beyschlag does,¹ that the Acts writer thinks of the appearance as visible to Paul's companions and therefore not a vision; for according to Holsten's theory the Christophany would be regarded as an objectively existent heavenly reality and as such visible to all present. And again, it is quite futile to contend that such appearances, regarded as visions of heavenly reality, would not have led the disciples and Paul to a belief in Jesus's bodily resurrection, for this Holsten himself acknowledges, taking refuge in the assertion that this material conception was the product of later tradition.

The vulnerable point in Holsten's theory is not its psychological impossibility, for psychologically it is not only possible but exceedingly plausible. Its vital defect lies in the fact that it is unhistorical, resting upon a gross misconception of the Biblical theory of visions and upon a false notion of the Jewish and apostolic doctrine of bodily resurrection. In the first place, it is untrue that in those times men made no distinction between vision and supernatural reality,² for the essential characteristic of the Biblical vision is its symbolism. But in the second place, as Beyschlag has further pointed out, the hypothesis of Holsten rests upon a Hellenistic doctrine of resurrection found only in Josephus and later writers.³ It is a mistake to lose sight of this fact and strive to show that "in this attempt to explain the rise of the Christophanies which led to the belief in Jesus's resurrection lies an inner contradiction, namely that the belief itself is always posited as giving rise to the visions" (Weiss). Certainly it is no contradiction to suppose that a sub-conscious belief in Jesus's resurrection, present in the disciples' minds on the basis of the greatness of Jesus's own personality, should come to full certainty in a vision. So when a final appeal is made to the empty tomb to refute the vision hypothesis (Beyschlag, Gebhardt, Güder, Weiss, and others), Holsten simply replies that the apostles thought of the resurrection as the clothing of the released soul with a new body of glory, the fleshy body being left to pulverise in the tomb, or else being mysteriously stolen, the theft being charged upon the disciples. The decisive question to be put to Holsten is simply this: What was actually meant and understood by the "resurrection" of Jesus? What did Paul himself understand by the term? There can be but one answer: he understood the living again of Jesus's entombed body, whether in material or glorified form.⁴ The resurrection body,

¹ *Theologische Studien und Kritiken*, 1864 and 1870.

² See Num. xii. 6-8; Gen. xli.: Acts x; xvi. 9; etc.

³ See also Steude, *Theologische Studien und Kritiken*, 1887.

⁴ So 1 Cor. xv. 4, where Paul mentions the tomb as an essential middle term between Jesus's death and resurrection, regarding the latter as a coming forth from the tomb accompanied by a transfiguring change (cf. Matt. xxvii. 53; John v. 28 f.). Even in the case of the decomposed body, Paul posited a connection with the new body; how much more in the case of the dead but not decomposed body of Christ! (Rom. viii. 3.) Of course the new body would not be the same

according to Jewish thought, was not a new and essentially different body from the earthly one; it was a body of flesh transformed into a body of glory. This position is fully supported by the emphasis placed upon Jesus's bodily resurrection by the primitive apostles and by Paul himself.¹ It is evident, therefore, that it is on these grounds that Holsten's whole theory falls to pieces, namely its misconception of Biblical visions and its un-Jewish resurrection doctrine.

We may notice, in passing, the theory of Holtzmann, which embodies the vision hypothesis in its most attractive form.² Briefly stated it is as follows: The exalted Christ is a life-giving spirit with a corresponding spiritual body, consisting not of flesh and blood, but having the form of the heavenly man.³ Paul's idea, therefore, of the Christ who appeared to him is of a fleshless and bloodless light-substance which by its very nature could become visible only to the inner man and which could appear only upon the mirror of his spirit.⁴ Holtzmann's conclusion is that the appearance at Damascus consisted simply in an inner vision of the heavenly man of Paul's previous thought, arrayed in a body of glory. This variation of the vision hypothesis depends upon the quite unwarranted assumption that Paul believed the "fleshless and bloodless light-substance to be by its very nature visible only to the inner man." This theory is unjustifiable in its disregard of the express statement of Acts, that the phenomenon was visible both to Paul and to his companions, and also in its perversion of the evident intention of Paul's own declaration that he has "seen the Lord." It is no less than precarious to attribute our modern philosophical conceptions to a Jew of the first century who was a disciple neither of Kant nor of Berkeley nor of Hegel.

It is wholesome to acknowledge, however, that the vision hypothesis as usually understood rests upon a very considerable basis of truth, and that in so far as it does so it must continue to command the attention of thoughtful men. It is no argument against it to say that it does not explain Paul's boast of having seen the Lord, that it does not account for the ethical character of the event, that the occurrence itself does not bear the marks of an ecstatic vision, etc. These and similar assertions are futile. If the desert journey, the midday heat, "the vast silence of nature," Paul's fatigue, his hitherto unrewarded search after a higher righteous-

in organism,—but the same as being the organ of the soul (Beyschlag; cf. 1 Cor. vi. 13 f.). To Paul our modern ideas of a purely immaterial existence deprived of all space relationships would have been inconceivable. (See also Weber, *System der altsyntagogen palästinischen Theologie, etc.*; Schultz, *Alttestamentliche Theologie*.)

¹ Acts i. 3, 22; ii. 31-36; iii. 15, 21; iv. 2, 33; v. 31; x. 40, 41; xvii. 31; Rom. i. 4; iv. 25; v. 10; viii. 10 f., 34; x. 9; 1 Cor. xv. 4; 2 Cor. iv. 14; v. 1. etc.

² Cf. Gilbert, *The Student's Life of Paul* (1899).

³ 1 Cor. xv. 44, 49 f.

⁴ 2 Cor. iii. 18; cf. iv. 6, and Philip. iii. 21.

ness, and his naturally meditative and visionary disposition will assist in an explanation of what took place, these facts must not be thrown out of court, even if their assistance require to be supplemented from another quarter. The rationalistic critic declares that these conditions explain the whole matter; with equal one-sidedness the defender of the traditional faith affirms that nothing short of a marvellous and stupendous miracle could have led to Paul's Christophany and conversion. In point of fact, neither the merely naturalistic hypothesis alone nor the supposition of a supernatural marvel alone is a satisfying explanation.

It is a serious mistake to judge Paul's Christophany solely according to our Western standards of thought and character. Paul's Orientalism entered into the very fabric of his being. And again, his chronological position in the relative progress of the race must never be lost sight of. Truth must ever be revealed (or discovered) under the necessary limitations of time and place and individual development. Is it religious truth alone which requires a miracle for its revelation? Or is the religious genius exempt from the laws of the human intellect, so that he must have a special dispensation of miraculous guidance? And when the revelation comes to him, are the natural means of communication so insufficient that only the extraordinary and inexplicable channels are available? Paul was a religious genius whose conversion was due to the intuitive comprehension of a great ethical truth, namely that his career of inquisition was a violation of his own best instincts, and that there was a law within more sacred than the external legalism which he was seeking to defend. This truth he perceived suddenly, intuitively, or to express the matter differently, he had an ethical and religious revelation from heaven. Both forms of expression are admissible; they are not mutually exclusive, for they merely state the two sides of one and the same truth. In what form should this revelation come to him? Let us remember that Paul was an Oriental, a Jew, a Pharisee, trained in the mysticism of his ancestral religion, immersed in the current philosophy and theology, and limited by the stage of development which the race had up to that time reached. The answer must depend in every case upon the individual. In our case it might be simple conviction; in Paul's case Christ himself appeared before the persecutor in a glorious body of light.¹

The distinction between vision and apparition is fully justified by the results of the most recent scientific research, which show unquestionably that there is an actual connection of some sort between the objective fact and the perception of that fact through an apparition where its perception through the senses cannot be supposed; and, moreover, that this connection is not due to chance.² Such apparitions, therefore, are not merely subjective visions originating in the mind of the

¹ Cf. Pfleiderer, *Paulinismus*.

² For instance, a census of such coincidental apparitions (many of the cases having been recorded before they were verified) showed that the number of coincidences was 350 times greater than the law of chance required. See Hyslop, "Results of Psychical Research," *Harper's Monthly*, April, 1900.

percipient; on the other hand, by some means we know not what, they are due to the operation of the mind of another. When Paul fell prostrate on the road to Damascus, he was conscious of being in the presence of a personality which transcended his own, the man whose name he had been persecuting, and who now stood before him as one from the dead, yet with all the appearance of objective reality. The visible manifestation was coincidental with Paul's conversion, yet not the cause of it, since we have already found the cause to have been ethical and not objective. This coincidence was not due to chance; there was a connection between the apprehension of the ethical truth and the experience of the visible manifestation. In other words, there was an apparition of an actually existent personal being. But at this point the objection will be raised that if the visible manifestation was not the cause of the ethical intuition, then the latter was the cause which produced the visible manifestation. We gladly admit this possibility, for we have just seen that there was a connection between the two events which was not due to chance, and now the nature of the connection becomes apparent. The intuition of ethical truth took on objective form and appeared to Paul as a visible manifestation. What then becomes of the evidence just adduced for the presence of an actually existent personal being other than Paul's self? The answer is quite clear: that evidence consists not in the visible manifestation but in the ethical intuition, whose source was the Author of truth. And once more, if it is objected that this is a mere play of words which leads us back to the simplest form of the vision hypothesis of a visible manifestation conjured up from the depths of Paul's own mind, we again acknowledge the fairness of the objection and at once declare our willingness to accept the vision hypothesis in its simplest form, but on one condition, namely that the origin of Paul's ethical intuition as coming from a divine personality be left undisputed. In that case, however, the appropriate term for the visible manifestation is not vision but apparition. The distinction is between the pantheistic and the theistic interpretations of the event.

After a life-long study of the problem of Paul's conversion, that keen-minded critic and rationalist Baur declared that the event was "a marvel whose inner mystery no dialectic or psychological analysis could explain." And even Renan has admitted that if Paul's conversion "was not a miracle in the old traditional meaning of the word, it remains a psychological problem forever insoluble by us of to-day." But happily the problem did not rest with the conclusions of Baur and Renan; for to-day it is neither a miracle nor an insoluble mystery. The apparition hypothesis¹ in which we find the ultimate solution accords not only with the testimony of the Biblical documents but also with a wider view of the nature of the "world ground" and of the method of divine revelation. Moreover, the same hypothesis will account fully for the previous appearances of the risen Lord to the

¹ The so-called "theistic vision" hypothesis, advocated by Lotze, Schweizer, and others.

disciples. It was no ordinary mortal whose life-blood had been poured out upon the summit of Calvary. To Peter and his companions the very idea of Jesus's death had been inconceivable;¹ and after the crucifixion they realised intuitively from their total impression of that tremendous personality that he was still alive, that he must in the very nature of the case triumph over death. In other words, this truth came to them as a divine revelation. As in Paul's case, the basis of this revelation was distinctly ethical. As in Paul's case the revelation (or intuition) took the form made necessary by the current modes of thought. Both with the disciples and with Paul the great spiritual truth was of necessity clothed in the imagery of Jewish theology. Acknowledged now as Messiah both by the disciples and by Paul, Jesus could not, according to their thought, remain in Sheol: with such a man death must be but the gateway into life. So overwhelming was this realisation that Jesus himself seemed to stand before them, visible to the eye of sense; an angel or spirit could be no longer supposed, and the bodily resurrection of Jesus was accepted and became the dogma of the primitive Church. And this is neither a mystery nor a miracle, since the apparitions came on the basis of psychological conditions which were undoubtedly present and can be clearly traced, and they came in striking harmony with the usual manner of apparitions as now beginning to be known to science through the data of hundreds of recorded instances.²

It has been argued that the two simultaneous acts, the one by Paul, the other by the spirit, were either interdependent or independent; that in the first case the Spirit caused Paul's conversion, and that in the second case the coincidence of the events was miraculous, so that we have a miracle in either case.³ Let us acknowledge that the events were interdependent, and that Paul's conversion was the work of the Spirit; but that it was a miracle, or in any wise out of harmony with recognised natural laws, cannot be demonstrated. And when it is urged that a visible apparition was bound to be in a certain sense objective since it involved the activity of the visual centres of the brain in order to the production of the optical illusion, and that the production of such an activity was as much a miracle as the presentation of a material form before the eyes would have been, we must again dissent, on the ground that the natural process of intuition (or revelation) involves brain activity and yet is not a miracle; and the activity of the visual brain centres is no more miraculous than that of the higher intellectual and moral centres.

¹ Matt. xvi. 22.

² One of the most clearly recognised principles in this connection is that such apparitions are in large part the creation of the mind of the percipient on the basis of a suggestion or of an intuitive apprehension of some truth not perceived through the material senses. In Paul's case this truth was the messiahship of Jesus; with the disciples it was Jesus's triumph over death; in each instance it was an ethical intuition on their part, an act of revelation on the part of the Absolute Personality.

³ Massie, *Expositor*, Third Series, Vol. X., 1889.

But finally, we should not pass unnoticed the apologetic objection to the apparition hypothesis, that it makes God, or Christ, the author of a sort of optical delusion, so that the Church with its hope of immortality was founded upon a lie. The objection is really of little moment. The Church with its hope of immortality was founded upon an ultimate reality—the personality of Jesus. The essential fact about the resurrection was that Christ had risen in final triumph over death. That this spiritual triumph was conceived of in very material fashion was a necessary incident of the times, a natural outcome of Jewish and popular thought, and not a part of the spiritual truth which came from God. As to what became of the material body of Jesus, let us acknowledge frankly that we do not know. Its removal by others without the knowledge of the disciples, or a mistake as to the tomb, or the immediate departure of the sorrowful company to Galilee—events such as these are not accidents but come to pass under the guidance of an all-wise Providence. And when Steude argues that the apparitions could not have resulted from a syllogism about the empty tomb in combination with the Jewish resurrection belief, but only from an actual experience with the mutilated body of the risen Lord, we grant that his argument might be just but for the omission of that great prime factor, the personality of Jesus himself. This, in the last analysis, was the basis of the divine revelation which came to the disciples and to Paul; and the manner of the revelation accorded fully with the intellectual and spiritual development of those to whom it came. All truth is a progressive revelation; in the course of time the hope of immortality has come to rest upon larger inductions than were possible to primitive Christianity.

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BOOK REVIEWS.

THE VARIETIES OF RELIGIOUS EXPERIENCE; A STUDY IN HUMAN NATURE. Being the Gifford Lectures Delivered at Edinburgh in 1901-1902. By *William James, LL. D.*, etc., Corresponding Member of the Institute of France and of the Royal Prussian Academy of Sciences, Professor of Philosophy at Harvard University. New York, London, and Bombay: Longmans, Green, and Co. 1902. Pages, xii, 534.

Professor James remarks in the opening lines of his preface: "This book would never have been written had I not been honored with an appointment as Gifford Lecturer on Natural Religion at the University of Edinburgh;" and the world therefore owes a debt of gratitude to that institution for the admirable production which lies before us. Few persons are better qualified than the author, by range of philosophic insight and human sympathy, to describe man's religious constitution. The work is brilliant at every turn, and the natural gloom of the subject has everywhere been lightened by flashes of wit and humor. Differ as one may from certain of the author's conclusions, or regarding his generous attitude towards the aberrancies of psychical research, one cannot help paying to this work the tribute of admiration that belongs to every classical expression of psychological inquiry.

It had been Professor James's original intention to give two distinct courses of lectures,—one descriptive, on man's religious appetites, and the other metaphysical, on their satisfaction through philosophy; but the unexpected growth of his material resulted in the second subject being postponed entirely, the description of man's religious constitution now filling the twenty lectures. The author has not omitted, however, to suggest his philosophic conclusions in a brief postscript. He hopes some day to be able to express them in more explicit form.

Professor James believing that greater wisdom lies in a large acquaintance with particular facts has, in his discussions, wisely eschewed abstractions; and has "loaded" his lectures with concrete examples "chosen among the extremer expressions of the religious temperament." His purpose in so doing has not been to offer a caricature of the subject, which may be the impression gained by some readers, nor to afford material for amusement, which in some cases he involun-

tarily does, but to obtain a sound basis of religious actuality to work upon, and all will join him in the belief that in the end his procedure has been justified. We shall consider in detail a few of the points which he has raised.

At the outset, Professor James makes an important distinction,—one which is commonly ignored. It is the distinction between questions of fact and questions of value. This is the logical distinction between the two orders of inquiry concerning constitution, origin, and history on the one hand, and importance, meaning, and significance on the other, the answer being given to the first in an *existential judgment* or proposition and that to the second in a proposition of value, or *spiritual judgment*. He says: "In the matter of religions it is particularly easy to distinguish the two orders of question. Every religious phenomenon has its history and its derivation from natural antecedents. What is nowadays called the higher criticism of the Bible is only a study of the Bible from this existential point of view, neglected too much by the earlier Church. Under just what biographic conditions did the sacred writers bring forth their various contributions to the holy volume? And what had they exactly in their several individual minds, when they delivered their utterances? These are manifestly questions of historical fact, and one does not see how the answer to them can decide offhand the still further question: of what use should such a volume, with its manner of coming into existence so defined, be to us as a guide to life and a revelation? To answer this other question we must have already in our mind some sort of a general theory as to what the peculiarities in a thing should be which give it value for purposes of revelation; and this theory itself would be what I just called a spiritual judgment. Combining it with our existential judgment, we might indeed deduce another spiritual judgment as to the Bible's worth. Thus if our theory of revelation-value were to affirm that any book, to possess it, must have been composed automatically or not by the free caprice of the writer, or that it must exhibit no scientific and historic errors and express no local or personal passions, the Bible would probably fare ill at our hands. But if, on the other hand, our theory should allow that a book may well be a revelation in spite of errors and passions and deliberate human composition, if only it be a true record of the inner experiences of great-souled persons wrestling with the crises of their fate, then the verdict would be much more favorable. You see that the existential facts by themselves are insufficient for determining the value; and the best adepts of the higher criticism accordingly never confound the existential with the spiritual problem. With the same conclusions of fact before them, some take one view, and some another, of the Bible's value as a revelation, according as their spiritual judgment as to the foundation of values differs."

As will be seen, the Professor is at once prepared to do justice to both sides of the question without damaging anyone's feelings.

Next, the neurological ground is cleared, and the medical materialism that seeks to undermine all the extremer forms of religious expression demolished.

The author describes the doctrine as follows: "Medical materialism finishes up Saint Paul by calling his vision on the road to Damascus a discharging lesion of the occipital cortex, he being an epileptic. It snuffs out Saint Teresa as an hysterick, Saint Francis of Assisi as an hereditary degenerate. George Fox's discontent with the shams of his age, and his pining for spiritual veracity, it treats as a symptom of a disordered colon. Carlyle's organ-tones of misery it accounts for by a gastro-duodenal catarrh. All such mental over-tensions, it says, are, when you come to the bottom of the matter, mere affairs of diathesis (auto-intoxications most probably), due to the perverted action of various glands which physiology will yet discover." The refutation of medical materialism is as follows: "Modern psychology, finding definite psycho-physical connections to hold good, assumes as a convenient hypothesis that the dependence of mental states upon bodily conditions must be thorough-going and complete. If we adopt the assumption, then of course what medical materialism insists on must be true in a general way, if not in every detail: Saint Paul certainly had once an epileptoid, if not an epileptic seizure; George Fox was an hereditary degenerate; Carlyle was undoubtedly auto-intoxicated by some organ or other, no matter which,—and the rest. But now, I ask you, how can such an existential account of fact of mental history decide in one way or another upon their spiritual significance? According to the general postulate of psychology just referred to, there is not a single one of our states of mind, high or low, healthy or morbid, that has not some organic process as its condition. Scientific theories are organically conditioned just as much as religious emotions are; and if we only knew the facts intimately enough, we should doubtless see 'the liver' determining the dicta of the sturdy atheist as decisively as it does that of the Methodist under conviction anxious about his soul. When it alters in one way the blood that percolates it, we get the Methodist, when in another way, we get the atheist form of mind. So of all our raptures and our drynesses, our longings and pantings, our questions and beliefs. They are equally organically founded, be they of religious or of non-religious content."

We cannot forbear also quoting here the refutation which the author offers of the theory that religion is a species of perverted sexuality: "It reminds one, so crudely is it often employed, of the famous Catholic taunt, that the Reformation may be best understood by remembering that its *fons et origo* was Luther's wish to marry a nun:—the effects are infinitely wider than the alleged causes, and for the most part opposite in nature. It is true that in the vast collection of religious phenomena, some are undisguisedly amatory—e. g., sex deities and obscene rites in polytheism, and ecstatic feelings of union with the Saviour in a few Christian mystics. But then why not equally call religion an aberration of the digestive function, and prove one's point by the worship of Bacchus and Ceres, or by the ecstatic feelings of some other saints about the Eucharist? Religious language clothes itself in such poor symbols as our life affords, and the whole organism gives overtones of comment whenever the mind is strongly stirred to expression.

Language drawn from eating and drinking is probably as common in religious literature as is language drawn from the sexual life. We 'hunger and thirst' after righteousness; we 'find the Lord a sweet savor'; we 'taste and see that he is good.' 'Spiritual milk for American babes, drawn from the breasts of both testaments,' is a sub-title of the once famous New England Primer, and Christian devotional literature indeed quite floats in milk, thought of from the point of view, not of the mother, but of the greedy babe."

In the second lecture, the topic to be studied is circumscribed. Religion is defined arbitrarily to mean "the feelings, acts, and experiences of individual men in their solitude, so far as they apprehend themselves to stand in relation to whatever they may consider divine." What this "divine" is remains in each case for interpretation, as for example in atheistic Buddhism and transcendental idealism. Dire necessity confronts us in our conduct; renunciation is the price of life.

"' Entbehren sollst du ! sollst entbehren !
 Das ist der ewige Gesang
 Der jedem an die Ohren klingt,
 Den, unser ganzes Leben lang
 Uns heiser jede Stunde singt.'

"For when all is said and done, we are in the end absolutely dependent on the universe; and into sacrifices and surrenders of some sort, deliberately looked at and accepted, we are drawn and pressed as into our only permanent positions of repose. Now in those states of mind which fall short of religion, the surrender is submitted to as an imposition of necessity, and the sacrifice is undergone at the very best without complaint. In the religious life, on the contrary, surrender and sacrifice are positively espoused: even unnecessary givings-up are added in order that the happiness may increase. Religion thus makes easy and felicitous what in any case is necessary; and if it be the only agency that can accomplish this result, its vital importance as a human faculty stands vindicated beyond dispute. It becomes an essential organ of our life, performing a function which no other portion of our nature can so successfully fulfill. From the merely biological point of view, so to call it, this is a conclusion to which, so far as I can now see, we shall inevitably be led."

Then, in successive chapters, replete with clever descriptions and analyses of concrete cases, Professor James treats of "The Reality of the Unseen," "The Religion of Healthy-Mindedness," "The Sick Soul," "The Divided Self, and the Process of Its Unification," "Conversion," "Saintliness," and "Mysticism." Lastly, the philosophical side of the subject is indicated. In religion, the primacy is that of feeling; philosophy is a secondary function, unable to warrant faith's veracity. Conceptual processes can class facts, define them, interpret them; but they do not produce them, nor can they reproduce their individuality. There is a plus, a thisness, which feeling alone can answer for. "In all sad sincerity," says Professor James, "I think we must conclude that the attempt to demonstrate

by purely intellectual processes the truth of the deliverances of direct religious experience is absolutely hopeless."

But there is one task that philosophy *can* perform for religion. "If she will abandon metaphysics and deduction for criticism and induction, and frankly transform herself from theology into science of religions, she can make herself enormously useful. . . . Sifting out unworthy formulations, she can leave a residuum of conceptions that at least are possible. With these she can deal as *hypotheses*, testing them in all the manners, whether negative or positive, by which hypotheses are ever tested. She can reduce their number, as some are found more open to objection. She can perhaps become the champion of one which she picks out as being the most closely verified or verifiable. She can refine upon the definition of this hypothesis, distinguishing between what is innocent over-belief and symbolism in the expression of it, and what is to be literally taken. As a result, she can offer mediation between different believers, and help to bring about consensus of opinion. She can do this the more successfully, the better she discriminates the common and essential from the individual and local elements of the religious beliefs which she compares. I do not see why a critical Science of Religions of this sort might not eventually command as general a public adhesion as is commanded by a physical science."

We conclude with the author's general characterisation of religion. Summing up in the broadest possible way the criteria of the religious life, Professor James finds that it includes the following beliefs :

- " 1. That the visible world is part of a more spiritual universe from which it draws its chief significance ;
- " 2. That union or harmonious relation with that higher universe is our true end ;
- " 3. That prayer or inner communion with the spirit thereof—be that spirit 'God' or 'law'—is a process wherein work is really done, psychological or material, within the phenomenal world.

" Religion includes also the following psychological characteristics :

- " 4. A new zest which adds itself like a gift to life, and takes the form either of lyrical enchantment or of appeal to earnestness and heroism.
- " 5. An assurance of safety and a temper of peace, and, in relation to others, a preponderance of loving affections."

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FRAGMENTS IN PHILOSOPHY AND SCIENCE; BEING COLLECTED ESSAYS AND ADDRESSES. By *James Mark Baldwin*, Ph. D. Princeton, Hon. D. Sc. Oxon, LL. D. Glasgow, Stuart Professor in Princeton University. New York: Charles Scribner's Sons. 1902. Pages, xii, 389. Price, \$2.50.

Dr. Baldwin has rescued in this volume certain fugitive pieces on philosophy, psychology, and life that would otherwise have dwelt in the oblivion of the periodical literature to which they were originally consigned. Their titles are : I. Phi-

losophy: Its Relation to Life and Education; II. The Idealism of Spinoza; III. Recent Discussion in Materialism; IV. Professor Watson on Reality and Time; V. The Cosmic and the Moral; VI. Psychology Past and Present; VII. The Postulates of Physiological Psychology; VIII. The Origin of Volition in Childhood; IX. Imitation: A Chapter in the Natural History of Consciousness; X. The Origin of Emotional Expression; XI. The Perception of External Reality; XII. Feeling, Belief, and Judgment; XIII. Memory for Square Size; XIV. The Effect of Size-Contrast Upon Judgments of Position in the Retinal Field; XV. An Optical Illusion; XVI. New Questions in Mental Chronometry; XVII. Types of Reaction; XVIII. The "Type-Theory" of Reaction; XIX. The Psychology of Religion; XX. Shorter Philosophical Papers; XXI. Shorter Literary Papers.

The essays cover a period of fifteen years, and were unfortunately omitted from the author's more deliberate publications. Dr. Baldwin has seen in them a philosophical unity which has demanded utterance. He says: "The group of philosophical essays are introductory to a developed view of the world. The critical and historical papers naturally stand more squarely on their own feet; yet they too walk in a direction, and carry their own signboards. The strictly experimental studies, on the other hand, give results which in so far justify their own presence here either as contributing something to their respective topics, or as announcing ideas which have proved in some small way fruitful in the later literature." He then grapples with the subject of signboards, fondles it, and summarises his philosophy as follows: "Now another signboard,—a personal signboard! My best thought of nature, my type of philosophy, is an Idealism which finds that the universe of science is, when all is said, a cosmos which is not only true but also beautiful, and in some sense good. Science tells us what is true; that is science's prerogative: and whatever may be science's final word about Nature, that word is in so far the truth of the matter. Philosophy then enters her questions: how can such truth be also good, beautiful, livable—or none of these? While others say other things, and many others many other things, I say—using the liberty of this preface—it is true and good *because it is beautiful*. Nothing, I think, can be true without being beautiful, and nothing can be, in any high sense, good without being beautiful. In the words of my colleague and friend Professor A. T. Ormond (*Foundations of Knowledge*, p. 228) 'the aesthetic principle is at the same time a demand and an intuition....an ideal requirement and an intuition under which our world completes itself....It represents the point in our conceptions where worth and truth coalesce and become one.'

"The ascription of beauty, a reasoned, criticised, thought-out ascription of aesthetic quality, is the final form of our thought about nature, man, the world, the All. Let this be our sign-board,—vague-seeming as it is!" μ.

PSYCHOPATHOLOGICAL RESEARCHES: STUDIES IN MENTAL DISSOCIATION. With Text Figures and Ten Plates. By *Boris Sidis, M. A., Ph. D.* Director

of the Psychopathological Laboratory. Published under the auspices of the trustees of the Psychopathic Hospital. Department of the New York Infirmary for Women and Children. New York: G. E. Stechert. 1902. Pages, xxii, 329.

The present work consists of a series of investigations undertaken with the object of studying the problems presented by the phenomena of functional psychosis. The author has selected six typical cases. The first study is concerned with the phenomena observed in dissociative states of functional psychosis, where attempts are made to bring about a synthesis of subconscious dissociate systems: and methods are here worked out to obtain subconscious reactions to stimulations. The results, the author declares, clearly reveal the nature of the phenomena in question. "Psychologically, functional psychosis is coextensive with the whole domain of the subconscious. Physiologically, functional psychosis is correlated not with organic neuron degeneration, but with functional disaggregation of whole systems of neuron-aggregates. In functional psychosis, the function apparently lost and destroyed is found to be present in the subconscious,—the loss of function is purely dissociative. The activity is preserved and the system is really unaffected, —it is only dissociated from other functioning systems." The second study deals with alcoholic amnesia and the bringing out of subconscious memories. The result of this investigation is that amnesia in general and alcoholic amnesia in particular does not necessarily imply a state of unconsciousness. The third study "traces the growth and development of a *persistent* dissociated subconscious system and the disturbances brought about by its *periodic eruptions* into the upper strata of mental life." The fourth study discusses phenomena of mental dissociation in depressive delusional states. The fifth is on mental dissociation in a case presenting limited psychomotor disturbances. The last study, on dissociated states of psychomotor epilepsy, "deals with the growth and development of a whole system presenting psychomotor disturbances apparently of an epileptic character."

The researches of Dr. Sidis are of great importance to the psychopathologist and psychiatrist, and not without a very extensive bearing on psychological problems proper. They also afford an excellent insight into the nature and methods employed in psychopathological investigations.

The index and the various plates are good, as is also the letter press. μ .

THE ELEMENTS OF MIND; Being an Examination Into the Nature of the First Division of the Elementary Substances of Life. By *H. Jamyn Brooks*. New York and Bombay: Longmans, Green & Co. 1902. Pages, xviii, 312.

Mr. Brooks has the firm conviction that he is able "to take the student of nature, whatever science he may be interested in, into fresh fields of experimental research, wherein, by a fortuitous train of thought," he believes he has "discovered the elements of mind, which, when compounded with those of Force and Matter, constitute the mysterious substance we call life." He was encouraged by Professor

William James and Dr. J. Beattie Crozier "to overcome the diffidence which otherwise would have prevented him courted publicity for ideas which are, perhaps, antagonistic to those of some of the profoundest thinkers the world has produced." Proceeding upon the observation that the majority of human vices are but virtues carried to extremes, and that consequently the impulses which initiated them must be natural and therefore wholesome, he declares that the elementary impulses leading to the vices are necessary in the formation of the perfect man, and that the virtues in their turn are nothing more than mere vicious impulses under the restraint of moderation. For example, thrift may become parsimony and even miserliness and avarice, liberality may become extravagance, pride arrogance, self-respect vanity, etc. "These curious developments show that the impulses leading to good and evil climaxes respectively, are not necessarily antagonistic, and that both are necessary in the perfect man,—that, in fact, a man with all good, and only good, impulses (as the world understands them) would be unfitted for practical life." The author then discovered that all the virtues and vices were of a complex nature when fully developed, but taking any individual virtue or vice in its emotional aspect, and tracing it backwards, that it became less complex, and indeed, in its first stage as an initial prompting, was of the simplest character. "The hypothesis then presented itself that these individual initial promptings, leading in every instance to a distinctive emotion, constituting the resultant virtue or vice, as the case might be, are the elements of Mind....If these really be the elements of Mind, then it seems to me that when they join with those of matter and force, they must constitute the elements of life, and that, consequently, the missing link at last is found."

This, then, is the gist of Mr. Brooks's investigations. The elements of matter have been numbered and named, and the elements of physical force are also partly known; but with regard to the elements of mind, apart from the other divisions of force and matter, it does not seem, as the author says, that it has ever been suggested that they exist.

Summarising, he says: "My hypothesis is, that life is a compound or commonwealth, of these elements of mind, allied with the elements of matter and the elements of physical force.

"And that the elements of mind like those of matter and force are actual technical elementary substances."

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STUDIES IN POLITICAL AND SOCIAL ETHICS. By *David G. Ritchie, M. A., LL. D.*, Professor of Logic and Metaphysics in the University of Saint Andrews; Late Fellow and Tutor of Jesus College, Oxford. London: Swan Sonnen-schein & Co., Ltd. New York: The Macmillan Co. 1902. Pages, ix, 238. Price, \$1.50.

Dr. Ritchie has collected in this volume certain articles on ethical topics which he has published at considerable intervals of time in the *International Journal*

of *Ethics* and *The Contemporary Review*, together with addresses on similar subjects delivered before the Co-operative Wholesale Society and the South Place Ethical Society of Finsbury. He reminds his readers that they are "exoteric discourses," as distinguished from technical esoteric inquiries. "It seems to me possible," he says, "to discuss practical questions of political and social ethics on the basis of what may be called evolutionary utilitarianism, without raising, or at least without discussing, metaphysical questions, provided that one may take for granted that faith in the value and meaning of human society and human history which is implied in all serious political and social effort. I hold, indeed, that a thoroughly scientific treatment of ethics is impossible without a philosophical basis; and that this faith, of which I have spoken, in the ultimate rationality of the world can only find a theoretical justification in a metaphysic or, in the Aristotelian phrase, in a theology."

In the first paper, he has considered the light which biological theories of evolution throw upon the history of human society and on the practical problems of human society. In the second lecture, he has discussed the question of political equality; in the third, that of law and liberty, or state interference; in the fourth, civic duties and party politics; in the fifth, the ethical value of the commemoration of past events; in the sixth, the problems of war and peace; in the seventh, the ultimate value of social effort; and in the eighth and last, the time-honored problem of free will and responsibility.

The author's views have everywhere been clearly and accurately stated, and will be found to be remunerative reading.

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THE PROBLEM OF METAPHYSICS AND THE MEANING OF METAPHYSICAL EXPLANATION. An Essay in Definitions. By Hartley Burr Alexander, Ph. D., Sometime Fellow in Philosophy, Columbia University. Columbia University Contributions to Philosophy, Psychology, and Education. Vol. X., No. 1. New York: The Macmillan Co. Berlin: Mayer & Müller, Markgrafenstrasse. 1902. Pages, 130. Price, 75 cents.

On the assumption that most of our differences in matters metaphysical are misunderstandings and due to our failing to apprehend one another's meanings, it has been the endeavor of the author of the present brochure to overhaul thoroughly our principal metaphysical concepts and to submit them to critical analysis and scrutiny. The subjects he has considered are such as the following: The Meaning of Knowledge, The Object of Knowledge, Explanation and Description, The Principle of Identity, The Principle of Causality, The Principle of Sufficient Reason, Truth and Its Criteria.

The book is thus essentially a study of terms. "It endeavors," in the words of the author, "to define our more elemental metaphysical concepts, and to show some shades of meaning conveyed by the words we use, aspects we might emphasise, distinctions we should render clear. But in this the author does not attempt

encyclopaedic lexicography: it is not his purpose to give exhaustive definition nor full historical exposition of the meaning of any term. It is only for method that the essay proceeds by definition; its purpose is to outline as clearly as possible the central problem and import of all metaphysic, and for the accomplishment of this no method is likely to prove so fruitful as the Aristotelian study of concepts. But it must not be understood that there is any endeavor at metaphysical construction. In all ways effort has been directed to the avoidance of this. . . . No final metaphysical solution is possible, because so long as human intelligence broadens metaphysical truth must alter. It is not independent nor static, but exists for knowledge alone."

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THE PSYCHOLOGICAL INDEX, NO. 8. A Bibliography of the Literature of Psychology and Cognate Subjects for 1901. Compiled by *Howard C. Warren*, Princeton University, with the co-operation of *J. Larguier des Bancels*, Paris, *Leo Hirschaff*, Berlin, *Charles D. Isenberg*, New York, and *W. H. R. Rivers*, Cambridge (Eng.). New York: The Macmillan Company. Pages, viii, 206.

The Psychological Index is now published not only as part of the *Psychological Review*, but also as a bibliographical supplement to Professor Baldwin's *Dictionary of Philosophy and Psychology*. This bibliography of psychological literature includes original publications in all languages, together with translations and new editions in English, French, and German. The many subjects cognate to psychology are catalogued, viz., anatomy and physiology, pathology, anthropology, criminology, general philosophy, etc. Two thousand nine hundred and eighty-five titles of books and articles are listed,—a number from which some conception may be gained of the extent of the annual literature of this department.

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RESEARCHES ON THE RHYTHM OF SPEECH. By *J. E. Wallace Wallin*, *Ph. D.* Reprinted from Vol. IX. (1901) of the *Studies from the Yale Psychological Laboratory*. Yale University, New Haven, Conn. 1902. Pp., 142. Price, \$1.00.

Dr. Wallin has presented in this brochure a very painstaking and exhaustive analysis of the rhythm of poetry. He first cursorily reviews the work done by his predecessors in determining experimentally the time relations of speech, and shows that improved methods of speech investigation are imperatively necessary. He adds: "Two types of methods may be used. The former is largely the method which has prevailed up to the present time. The sounds of spoken language have been measured by means of finger beats, currents of air, and non-reproducible sound vibrations. A more direct method consists in measuring directly the sounds recorded in, and reproduced by, a talking machine." The experiments based on these methods were begun in the early summer of 1900 and carried out in the academic year of 1900-1901.

The theoretical and critical burden of his investigation is contained in the concept of the "Centroid." Any portion of speech such as "the cities are full of pride," is physically a vibratory movement of a complicated form of which various portions can be assigned in succession to different sounds, with more or less abrupt changes (glides) between them. This series of sounds represents: "(1) a continuous succession of vocal movements representing work, (2) a continuous vibration of an air particle, (3) a continuous succession of sensations. Both the speaker and the hearer feel the recurrence of points in the succession at which the impression reaches a maximum. These maxima are felt to have their positions determined, not only by the actual maxima of vocal effort and of acoustic impression, but also by the preceding sounds and by the anticipation of following ones. Owing to these circumstances, the maxima as felt may differ more or less from the actual vocal or acoustic maxima. Such a maximum of effect may be called a 'centroid.'"

Considering a poetical line as a certain quantity of speech-sound distributed so as to produce an effect equivalent to that of a certain number of points of emphasis at definite intervals, the location of the point of emphasis becomes the thing to be determined, and it is determined by the strength of the sounds at and around it. This point of emphasis is like the centroid of a system of forces. The centroid is thus not a syllable nor a single sound, but a point in the course of a sound (Scripture). The methods of locating the centroid are then developed, the elements and the essence of the centroid indicated, and the principles applied to various selections from English, Swedish, Persian, and Japanese poetry, with results which will, in all likelihood, stagger poets, and at the precise value of which they will certainly wonder.

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ZEITSCHRIFT FÜR ALLGEMEINE PHYSIOLOGIE. Herausgegeben von Dr. Max Verworn, Professor der Physiologie und Direktor des physiologischen Instituts an der Universität Göttingen. Erster Band. Erstes Heft. Mit 2 Tafeln und 4 Abbildungen im Text. Jena: Verlag von Gustav Fischer. 1902. Pages, 156. Price, per volume, 24 Marks.

Proceeding from the principles which have been laid down by him in his large and well-known work on *General Physiology*, Dr. Max Verworn has established the present *Zeitschrift für allgemeine Physiologie*, for the realisation of the general ideals which should control every department of research and thought. It is designed to be a trysting-place for inquirers in provinces connected with the biological sciences, being devoted to all the phases of that joint research which has to do with the investigation of the most general problems of life, and including the fields lying between physiology and anatomy, physiology and botany, etc. It will contain original researches, reviews, discussions, and similar topics. It will also have an international character. The present number, which is neatly got up, contains besides the introductory remarks by the editor, the following articles:

"Zur Kenntnis der Narkose," by Hans Winterstein, "Neue Versuche zur Physiologie der Befruchtung," by Emil Dungern, "Ueber die Reaktion des Blutserums der Wirbeltiere und die Reaktion der lebendigen Substanz im Allgemeinen," by Hans Friedenthal, and "Inanitionerscheinungen der Zelle," by Hans Wallengren.

The field of this periodical is a promising one, and from the contents and appearance of the first number it seems destined to fulfil the ideals which the editor has set himself. We wish it all success.

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NÄTURLICHE SCHÖPFUNGS-GESCHICHTE. Gemeinverständliche wissenschaftliche Vorträge über die Entwicklungs-Lehre. Von *Ernst Haeckel*, Professor an der Universität Jena. Zehnte verbesserte Auflage. Mit dem Porträt des Verfassers und mit 30 Tafeln, sowie zahlreichen Holzschnitten, Stammbäumen und Tabellen. Zwei Bände. Berlin: Druck und Verlag von Georg Reimer. 1902. Pages, lxxi, 368.

The fact that this popular and lucidly written work of Haeckel's has, in spite of the drawbacks for which it has been criticised, reached in thirty-four years its tenth edition of six thousand copies is at once proof of its sterling value and of the enduring interest of the public in the monistic doctrine of evolution. In literary quality and clearness Professor Haeckel's scientific exposition could hardly be excelled. It bears constantly on the broader philosophical problems and so never lags in interest. Adding to this the great skill shown by the author in the selection and construction of illustrations and diagrams, we may say that whatever the objections that have recently been raised to some of Professor Haeckel's personal scientific and philosophical theories, his work is destined to remain for a long time to come the most entertaining and most instructive natural history of creation. μ.

LES PHÉNOMÈNES ELECTRIQUES CHEZ LES ÉTRES VIVANTS. *Scientia* No. 13. Par *Maurice Mendelssohn*. Paris: C. Naud, Éditeur. 1902. Pages, 99. Price, 2 Francs.

MODE DE FONCTIONNEMENT ÉCONOMIQUE DE L'ORGANISME. *Scientia* No. 14. Par le *Dr. A. Imbert*, Professeur à la Faculté de Médecine de l'Université de Montpellier. Membre correspondant de l'Académie de Médecine. Paris: C. Naud, Éditeur. 1902. Pages, 97. Price, 2 Francs.

L'ÉLECTRICITÉ DÉDUIITE DE L'EXPÉRIENCE ET RAMENÉE AU PRINCIPE DES TRAVAUX VIRTUELS. *Scientia* No. 19. Par *M.-E. Carvallo*, Docteur ès sciences agrégé de l'Université. Examinateur de mécanique à l'École Polytechnique. Paris: C. Naud, Éditeur. 1902. Pages, 91. Price, 2 Francs.

We have frequently before called attention to these admirable *résumés* of the present state of scientific inquiry regarding special topics in physics, mathematics, biology, etc., published under the collective name of *Scientia*. These little works are artistically and accurately got up, and are in every way worthy of the attention of the scientific public.

The first of the three books above listed is concerned with electrical phenomena among living organisms. It treats of the history of the subject, of the electrical phenomena of the muscles and the nerves, of electric phenomena in man, of the electric phenomena of the skin and the glands, of the electric phenomena of the nervous centers and the sensory organs, of electric fishes, electric phenomena in vegetables, the theory of electrogenesis in living beings, and concludes with some general considerations on the rôle played by electric phenomena in the manifestations of life. The author says that there are many uncertainties still regarding the question of the relation of animal electricity to the physico-chemical manifestations of the organism, yet he maintains it can be affirmed quite positively that the electric phenomena produced in the living organism result from nutritive functions of the cellular life and take part in the physico-chemical changes going forward in a living organism during activity and even rest. The electric energy which is found in living organisms and which reposes there in a potential state, enters into all the nutritive functions of the cellular life, and constitutes one of the forms of energy of which the organism is the producer and transformer. Therefore, this organic electricity must necessarily obey, at least within certain limits, the immutable law of the conservation of energy and the equivalence of forces. In this respect the electric phenomena common to animals and plants, the author concludes, conform to the principle of the fundamental unity of life.

In the second work Dr. Imbert has considered the *economic functioning* of living organisms,—the ratio of the energy engendered to the total work accomplished. In machines this ratio is always less than unity. The difficulty of the investigation with organisms is that it is not easy to discover the precise nature of the organic motor. We know, however, from the researches of Chaveau, that in the animate motor this ratio is variable, though increasing according as the muscle or organ producing the energy acts under less contraction. It is impracticable for us to go into details; we can only say that the author has reached the conclusion that it is possible to realise *voluntarily* the conditions that correspond to a minimum expenditure of energy relatively to the nature and the form of the motor acting.

The third work, by Dr. Carvallo, is entitled *Electricity Deduced from Experiments and Reduced to the Principle of Virtual Velocities*. Admirable as the work of Maxwell may be, the author remarks, it is nevertheless obscure and its commentators have not sufficiently elucidated it. Therefore another mode of attack seems desirable, that of the mechanical interpretation of the experimental laws. The author has announced two fundamental principles which are generalisations of the two laws of Kirchhoff and which make the electric field a system with connections obeying the principle of virtual velocities. He has reverted, therefore, to rational mechanics in his explanations. But an electric system is not a system the freedom of which is finite, but an indefinite *milieu* analogous to an incompressible fluid in which ponderable bodies float with the ordinary connec-

tions of rational mechanics. The equations of these connections and the equations of the virtual velocities are, as above remarked, of two kinds: the first relating to the movements of matter on the one hand, and the second to electricity on the other. The equations relative to electricity are the two fundamental laws of which Kirchhoff has announced a special case,—the law of the incompressibility and the equilibrium of electro-motor forces throughout their entire confines. The other equations are the ordinary equations of rational mechanics. μ.

IGNATII ANTIOCHENI ET POLYCARPI SMYRNAEI EPISTULAE ET MARTYRIA. Edidit et adnotationibus instruxit *Adolfus Hilgenfeld*. Berolini: Sumtibus C. A. Schwetschke et Filii. 1902. Pages, xxiv, 384. Price, 10 Marks.

The present work is a complete annotated and critical edition of the letters and testimonials of Ignatius of Antioch and Polycarp of Smyrna. St. Ignatius died early in the second century, having, according to tradition, suffered martyrdom under Trajan. He is the reputed author of Epistles to the Ephesians, Romans, Magnesians, Philadelphians, and to Polycarp. Polycarp was the author of an epistle to the Philippians. The texts are mostly in Greek, and the learned and venerable editor, Dr. Adolf Hilgenfeld, has supplied a preface in Latin.

A new edition of *Webster's International Dictionary* has been announced by the G. & C. Merriam Company, of Springfield, Mass. An entirely new set of plates for the work has been made, for incorporating 25,000 additional words, phrases, and definitions. The volume contains 2365 pages and 5000 illustrations. For practical and rapid reference the new edition of *Webster's International Dictionary* retains its distinctive advantages.

ERRATUM.

The author of the book *Phantasien eines Realisten*, noticed in the April *Monist*, p. 478, was erroneously given as Irvin Bauer. The real author is Joseph Popper, a prominent engineer of Vienna. Mr. Popper's writings on ethical as well as scientific subjects are well known in Germany and Austria and are all distinguished for their philosophical insight and the perfection of their literary form.